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# The Business Side of Tooling

H. C. MILLER
*Saginaw Steering-Gear Division,*
*General Motors Corporation*

**The selection of new shop tooling embodies two distinct phases: the mechanical and the economic**

KEEN competition, higher wage scales, and rapidly changing designs are collectively responsible for making the present-day problem of tooling up for production far more complex than it was a few years back. Not that it is more difficult to find manufacturing equipment that will perform suitably the purely mechanical operations, for with modern machine tool development, nothing could be further from the truth. The real problem is to select equipment that combines satisfactory mechanical performance with correlation to the general picture as viewed by management from the strictly business standpoint. This calls for a careful analysis of all facts for each individual case.

To summarize, there are three major requirements that any piece of equipment must meet to be considered desirable as a modern production unit. Listed in order of importance, these are:

1. Mechanical adaptability to the production of parts built to the high standard of engineering quality demanded by the customer.

2. Design that will permit operators to produce quality parts in such average hourly quantities that an adequate return on the investment will be insured. Furthermore, the construction must be economical from a maintenance standpoint.

3. Flexibility of design and construction that will readily permit of economical adaptation to similar parts. This will avoid early obsolescence, except that occasioned by radical engineering changes in parts, in which event the equipment, because of its adaptability to other work, should carry an appreciable potential resale or trade-in value.

The first and most important requirement is by far the easiest of the three to meet. Almost any line-up of good standard machines, when properly tooled and handled, will produce parts to blueprint specifications. The real problem begins, when as at present, knife-edged competition demands that high grade parts be produced at greatly reduced costs in the face of high labor rates. At the same time, management insists that the equipment be so selected as to minimize the chance of premature obsolescence, and so purchased that the required capital investment will be in keeping with the returns anticipated.

A few years back when preparing to manufacture a new part, the customary procedure was to purchase mechanically suitable equipment; then after installation, to arrive at approximate productive labor costs; to add some sort of burden rate and a hoped-for margin of profit; and to turn the whole thing over to the sales department to "put across." For a time, this worked more or less satisfactorily. But that was in the days when competition was much less formidable. Because of a radical change in conditions, this procedure has been exactly reversed. Nowadays, the costs and selling prices of commercial articles are definitely figured and established in advance. The amounts to be expended on a given project are predetermined and definitely written into a program, which is handed the tool engineering division with instructions that it be rigidly adhered to. The problem now is not one of fitting the business program to the job of tooling up, but of fitting the tooling up to the business.

To go about the work of properly selecting entirely suitable equipment for a given project, certain positively reliable facts must be available. Since the element of time is now more than ever a most important factor, these facts and figures must be arranged systematically and filed so as to be readily accessible. Anyone who is familiar with the formal quotations, used by various machine tool builders throughout the country, has undoubtedly observed two things common to them: First, taken individually, each has a number of good points in its favor. Second, taken collectively, they present a heterogeneous mass of information that uses up hours of valuable time if fair decisions are to be made when comparisons are attempted.

Formal quotations, because of their present complete

## MACHINE QUOTATION RECORD

GENERAL PRODUCTION COMPANY

NOTE—All spaces left blank must be properly filled in and this sheet returned, with your quotation, to the General Production Company. Your prompt attention will be appreciated.

GENERAL PRODUCTION COMPANY

For General Production Company. Part No. _____ Part Name _____

Operation No. _____ Operation _____

We recommend and quote the following equipment: One—

Delivery from receipt of formal order . . . . . _____ Weeks

Price of Machine, Only, arranged for { Belted / Direct / Chain } Motor Drive . . . $ _____

Extra for mounting motor (Supplied by General Production Company. . . _____

Extra for all necessary tools, tested and mounted in place . . . _____

Extra for pumps, piping, etc., as per attached quotation . . . . _____

Extra for all other necessary equipment as per attached quotation . . . _____

Total for machine fully equipped as we recommend it . . . . $ _____

Removing from _____ to _____ of normal machinable stock at the following recommended feeds and speeds: { Cutter / Work } _____ R.P.M. feed _____ inches per minute; surface feet _____ per minute which we reserve the right to demonstrate, satisfactorily, can be maintained on average daily production, we guarantee the above quoted fully equipped machine, when operated at 80% efficiency, to produce _____ pieces per hour (floor-to-floor production) of the General Production Company. Part No. _____ Operation No. _____ as per their blueprint (Date)

Submitted by (Company's Name) _____

(Company's Address) _____

Per _____

(Date) _____

(See Other Side)

In the enclosed space, below, draw an accurate, diagramatic floor-plan layout of your quoted equipment, using exactly 1/4" = 1' scale. Also, designate operator's working position by means of 1/4" dia. circle. Use ink for this work.

GENERAL PRODUCTION COMPANY

Motor Recommended:---------H.P.---------R.P.M.---------Req'd.

" " ---------H.P.---------R.P.M.---------Req'd.

" " ---------H.P.---------R.P.M.---------Req'd.

Starter Equipment Recommended:

Estimated Weight of one complete machine, fully equipped, mechanically and electrically:--------pounds.

F.O.B. Point:----------

Freight Rate from F.O.B. Point to Saginaw per 100 lbs:

L.C.L. $--------- Carload $---------

Recommended Routing:

Signed By----------

Date----------

**This "Machine Quotation Record" constitutes a condensed, systematic arrangement of vital information essential to rapid and accurate selection-by-comparison of equipment suitable to a given manufacturing program**

pected to do. Specifically the form provides for:

1. A definite statement regarding the part number, part name, operation number and operation description for which the quoted equipment is intended.
2. A brief but adequate description of the equipment.
3. A definite delivery date.

lack of uniformity, defeat the very purpose to which they should be best adapted—namely, that of providing a quick means of investigating the relative merits of competing equipment. It is only necessary to glance through a group of them to be convinced of the truth of this statement. Because of this the writer uses the so-called formal quotation as a basis of elaborate detail study, only on those machines tentatively selected by other means, and prefers to make both first and final decisions from certain "Machine Quotation Records" worked out for this purpose. These forms have the definite merit of incorporating about all the information needed in clearly worded, compactly arranged, uniform statements. Their use provides a standardized group of readily accessible facts and figures.

A form similar to our forms is reproduced for the information of those who may wish to study it carefully. It is printed on both sides of standard size, 8½x11 inch, three-ring binder paper for compactness. The notes at the top on each side are in red ink to indicate exactly what the quoting company is ex-

4. A cost breakdown arranged for quickly separating the total deferred expense from the capital investment.
5. A grand total cost of the machine when fully equipped with all pumps, fixtures, and one set of specified perishable tools.
6. A definite production guarantee, so worded as to be absolutely fair to both parties to the deal.
7. A formal signature layout that applies to everything on the front of the sheet.

On the opposite side:

8. A space for making an accurate ¼-in. = 1 ft. diagrammatic floor plan in ink—most essential for layout work.
9. Recommended electrical equipment specifications.
10. Estimated weight figures.
11. F. O. B. shipping point.
12. Freight rates.
13. Shipping route.
14. A signature layout for the back of the sheet.

Let us assume that the manager of a manufacturing plant has called a meeting of his executives to issue instructions regarding a new job which he contemplates placing on the market. The stipulations as to quality, cost, and investment have been thoroughly gone over. Instructions have been given that all capital investment, deferred expense, and operation charge items for appropriation purposes must be available within a period not to exceed thirty days from the date of the meeting. The maximum amount allowed for the appropriation is given with a request that it be pared down to the lowest possible figure.

With this information, the tool engineering division, working in close cooperation with the standards division, quickly draws up a tentative process routing. This must be in sufficient detail, however, to permit its use by the various machine tool engineering departments in working out their proposals. Then comes the job of calling in the salesmen and talking things over with them, individually. Each one is handed a quantity of blueprints, a sufficient number of tentative routings, and two of the "Machine Quotation Records" for each of the formal quotations anticipated. One of the "Machine Quotation Records" is to be kept by the quoting company and the other filled out, signed, and returned together with the formal quotation for the operations quoted upon.

As the formal quotations and "Machine Quotation Records" are received, they are roughly gone over to see whether any major corrections are necessary. If none are required, they are filed as follows:

The "Machine Quotation Records" are placed in good substantial three-ring binders in the order of their proper part numbers and operation numbers. Large, full-size index sheets with tabs are used for this purpose. As many as ten or more may appear under a given index, all submitted for consideration on one particular operation and possessing the virtue of being identical as to form and style. The formal quotations are filed in corresponding order, but in the usual cabinet drawers.

Now comes the task of elimination. At first thought, it might seem that those machines having the lowest total cost as compared to others, carrying approximatedy the same production guarantee, would be given first choice. But this is not always the case; it often happens that one machine, costing less than another, is so designed as to call for the use of considerably more electrical equipment. Since this is usually purchased separately, it may bring the total capital investment to a higher figure than that of the first machine. Then too, one machine may have a greater total cost than another, but may include a greater proportion of deferred expense, making the capital investment lower—in which case it would probably be given the preference.

Space will not permit a detailed study of the many well known questions which must be considered in making such decisions; but, in general, the whole problem sifts down to the use of comparative analysis worked out on the basis of simple mathematical calculation. The "Machine Quotation Record" furnishes the necessary working material for this calculation in condensed but readily available form. The mere turning of a few sheets gives one the complete business picture as presented by a number of competing machines. An ordinary three-ring binder will hold the condensed equivalent of a cabinet drawer filled with miscellaneous formal quotations.

From the foregoing the impression may possibly have been gained that the mechanical side is being completely forgotten; but this is decidedly not the case. There never was a time when more was demanded mechanically from a piece of equipment than at present; and this demand will steadily increase as time goes on. The thought is simply this: there is no merit in spending valuable time investigating the excellent mechanical features of equipment that sound business judgment has definitely ruled out of the picture in a given program. Such a piece of equipment is sure to be a poor investment, and certainly no one is looking for that kind just now.

Perhaps the answer lies with the machine tool builders themselves. Machines incorporating massive beds, designed and built to take demountable and adjustable units of rigid construction—all manufactured by "straight-line methods"—will go a long way toward solving the production versus investment problem.

■

## Discarding the Split Wormwheel
### *Discussion*

U. Seth Eberhardt
*Works Mgr., Newark Gear Cutting Machine Co., Inc.*

IT SEEMS to me that J.R.G. and the gear expert whom he mentions in his article on page 936, Vol. 73, have an erroneous impression. My father has been using the split wormwheel method for over 60 years, not as the last word in accuracy, but as the simplest and most practical method to gain any degree of accuracy needed. It is, also, the most practical method we have found yet to check the error of the finished wormwheel. After the wheel is cut, the ring is shifted half way, or any other part of a circle, and a tooth should be set even with the body of the wormwheel. By feeling on the opposite side any error is doubled.

We have made wheels 50 in. diameter with less than 0.0001 in. error. In other words, this method makes each gear, if necessary, an original masterpiece, just like making three surface plates and scraping them together gives you three master plates in each case, not a copy of something which is assumed to have no error.

# Determining the Concentricity of

RENE LEONHARDT
*Askania-Werke A. G., Berlin Germany*

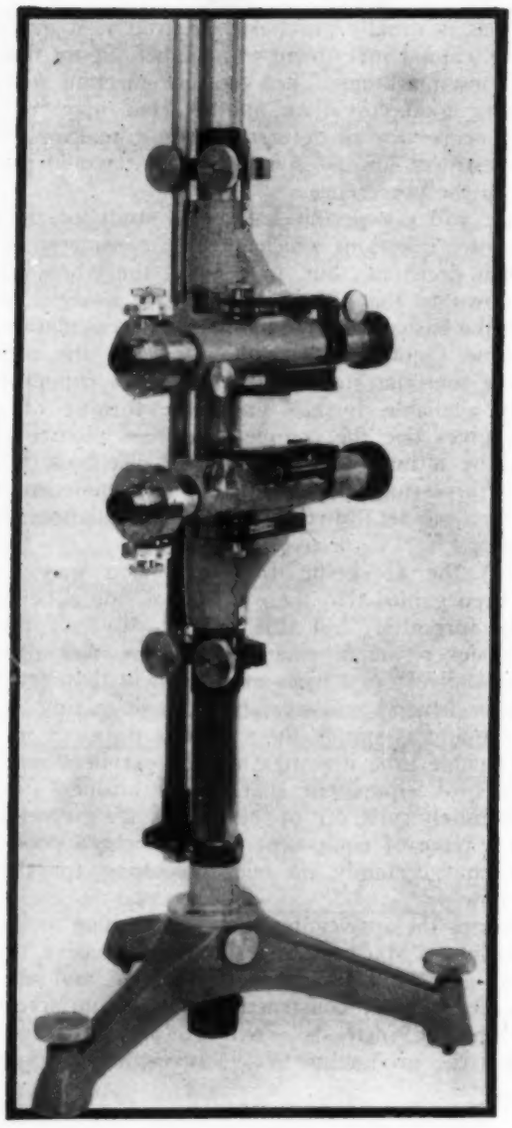

**Fig. 1—The Cathetometer with its twin telescopes. With a known length of feelers it is only necessary to adjust the telescopes to the illuminated target on each, and read the thickness on the telescope standard. Readings from four axes show any eccentricity**

OF the many working-material and production tests highly stressed hollow shafts, especially turbine shafts, are submitted to, one worthy of special attention is the checking of the concentric alignment of bores.

In the case of turbines for instance, an unequal thickness of wall caused by an eccentric bore, may easily prove disastrous because of the extraordinary forces applied. Short hollow shafts with a large diameter may be examined for cracks, scratches, rusty spots, pipes etc. by means of comparatively simple equipment. One may also detect misalignments of bores in such objects by simple mechanical means. However, where the objects to be examined are long and of small diameter there arise several difficulties which necessitate the use of some special appliance.

In the manufacturing of turbines, tests of this kind are of special importance. For this industrial branch, therefore, optical equipment has been developed which enables the above-mentioned requirements to be filled without further complications. The method employed is based upon an examination of the thickness between inside and outside diameter, carried out in such a manner that the distance is measured between corresponding points of the inside and outside surfaces. For better understanding of this method, a brief description of the apparatus used will be given first.

The equipment developed for the determination of misalignments of bores in hollow shafts consists of two separate units, one of which serves to determine the outside diameter of the shaft, and the other to measure the diameter of the bore. For the measurements on the circumference, a U-shaped rest is used, equipped with a feeler marked by a cross. This feeler, illuminated by a lamp, moves in a guide and contacts by its own weight with the object to be tested. In order to ascertain that the feeler always touches the highest point of the object, the U-shaped rest is equipped with a precision level for horizontal adjustment. The bore is measured by a similar feeler pressed against the internal surface. This last named feeler, which is also crossmarked, is mounted in the head of a tubular body and, out of use, is telescoped inside the head. The exact vertical position of the feeler is also adjusted by a precision level located on the head. A centering device permits the tubular body to be held exactly in the center of the bore. By means of a special scale and a knurled ring the centering device may be adjusted for bores of different diameters. A special depth-gage is used for the measurement of the adjustment. Where hollow shafts with especially large diameters are to be tested, the pins may be exchanged for longer ones. Extension rods to be screwed on the tubular body make the apparatus adaptable to objects of any length. A measuring tape fastened to the tubular body serves to indicate the particular position of the feeler inside the bore, and enables the feelers of both the internal and external measuring device to be placed exactly opposite each other.

The measurement proper is carried out in the following manner: The shaft to be tested is supported in an approximately horizontal position. An accurate horizontal adjustment is not essential, because the sole objective is the determination of the difference in height of the two cross marks, which immediately indicates the thickness of the wall. First, at one end of the shaft a cathetometer equipped with two observation telescopes and an eye-piece micrometer is mounted as closely as possible in front of the bore. After having set the

# HOLLOW SHAFTS

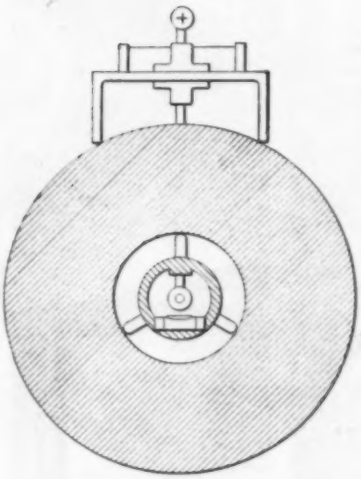

Fig. 2—Schematic layout of the measuring device as used in a hollow shaft. End view

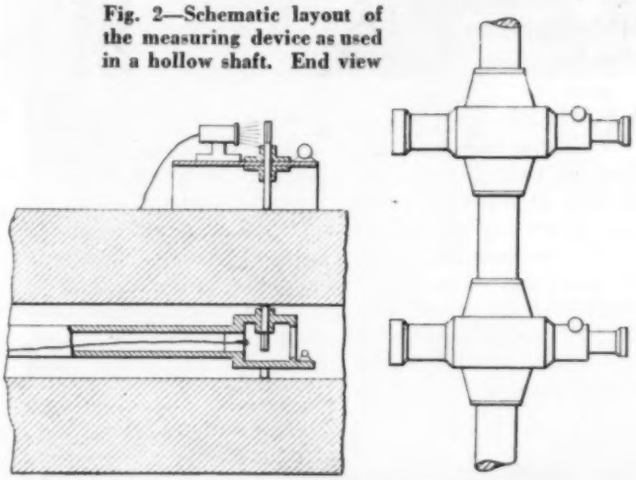

Fig. 3 — Cross section view showing the feelers in place and their relations to the twin telescopes

horizontally adjusted rest on top of the shaft, the cross mark of the feeler in the U-shaped rest is sighted by the upper telescope of the cathetometer, accurately adjusted vertically. After taking the reading for the mark—full millimeters are read from the vernier and fractions from the drum—the internal measuring device is inserted from the other side. Here, also, the feeler is first adjusted vertically by means of the level. The cross mark of this feeler is then sighted by the lower telescope of the cathetometer and the reading taken as described above.

As mentioned above the cathetometer is equipped with reading micrometer the drums of which are divided into 50 parts. The thread of the drum spindles has a pitch of 0.25 mm. (0.0098 in.) Thus, one drum interval corresponds to a difference in height of 5-1000 mm. (0,00019 in.) This accuracy however is only obtainable if the difference in height to be measured is located within a distance of 20 cm. (7.8742 in.) as naturally its magnified image decreases with increasing distance. Because of this fact, at a distance of 400 cm. (13 ft.) the accuracy is about $\frac{1}{10}$ mm. (0.0039 in.) this still being sufficiently accurate for the measurement of such large objects.

After having taken the readings just described, the shaft is turned around its axis, i.e. in the direction of its future rotation, by an angle of 60 deg., 90 deg. and 120 deg. respectively, and the measurement repeated for each of these positions. By further rotation and measurement, the original position is resumed; one set of measurements being thereby concluded. Now both measuring devices are pushed further inside the object under test; that is, towards its center, by a distance of, say, 20 cm. The measurements are then repeated for each angle of rotation. This procedure is repeated until the center of the shaft is reached. At this stage the internal measuring device is taken out of the shaft and the latter is turned around to an angle of 180 deg. in such a manner that its other opening faces the cathetometer. The inside measuring device is then inserted again and the entire process repeated until the center of the shaft is again reached. In this manner series of measurements are obtained according to the distances chosen, and from these comparisons of corresponding points of measurement, the various thicknesses between inside and outside surface may be determined, and also any misalignment of the bore.

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## Assembly and Responsibility—*Discussion*

WILLIAM BRYCE
*Sheffield, England*

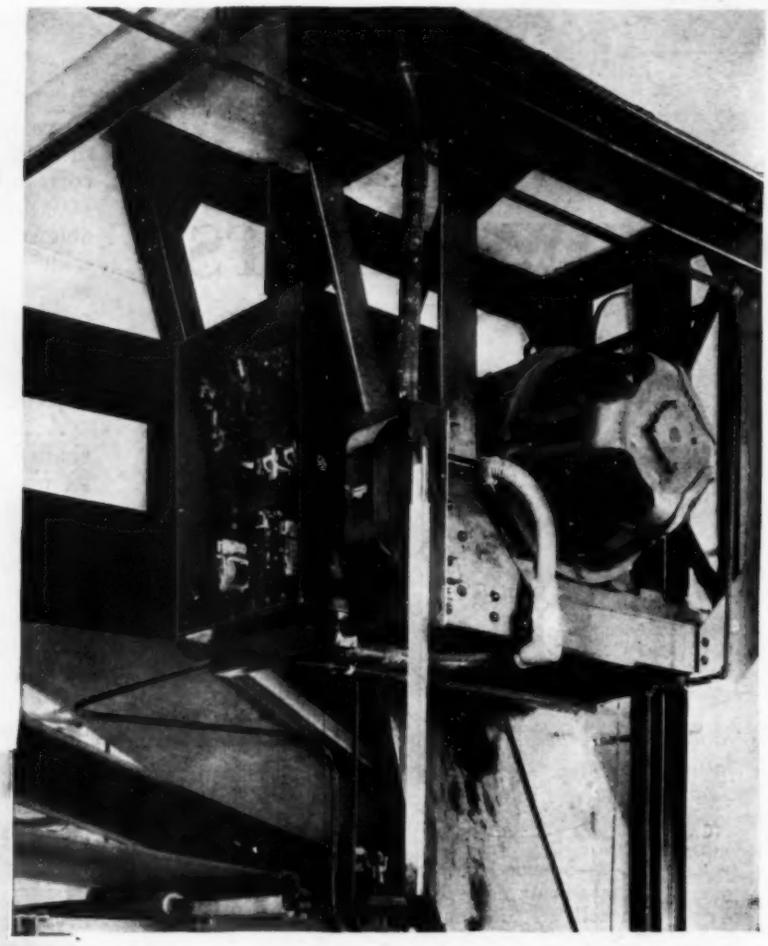
EMPHASIS of the importance of assembly (*AM*—Vol. 74, page 370) is much needed. It is unfortunately true that customers frequently have trouble through parts failing during the first few hours of use. Nuts come loose, levers foul, cotters are missing, oil holes are omitted, rattles develop, cables pull out of nipples, and bad work shows itself in various ways. I have known cables to pull out of nipples within the first hour because they had never been splayed over before soldering. Such shoddy work is a bugbear to the customer and the ruin of a firm's reputation.

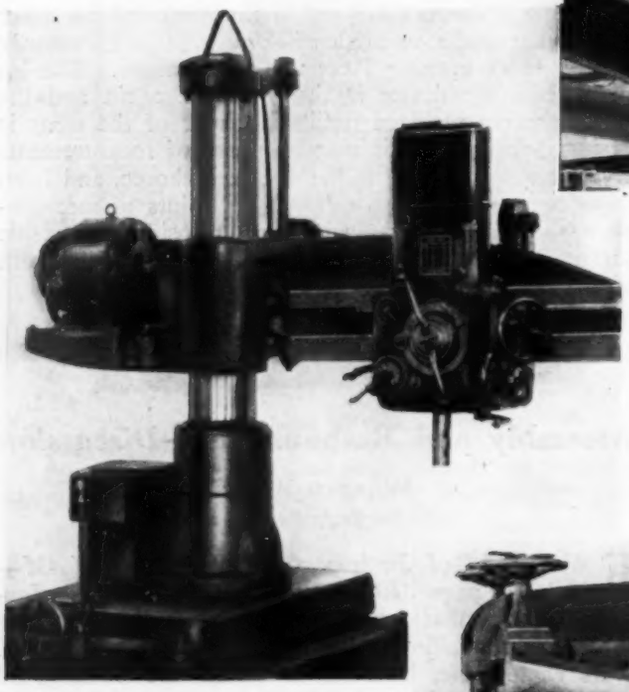
This is no exaggeration. It occurs daily. The assembler's work is so vital that he should detect these things as he proceeds, otherwise it reflects upon him. This department should not be unduly rushed, nor paid too parsimoniously, but recognized as being responsible for doing work to a standard rather than to a price. I am convinced that firms need to concentrate on quality rather than quantity, especially in the assembly department.

# PROPER MOTOR MOUNTING

**Carl L. Peterson**
*Industrial Engineer,*
*Reliance Electric & Engineering Company*

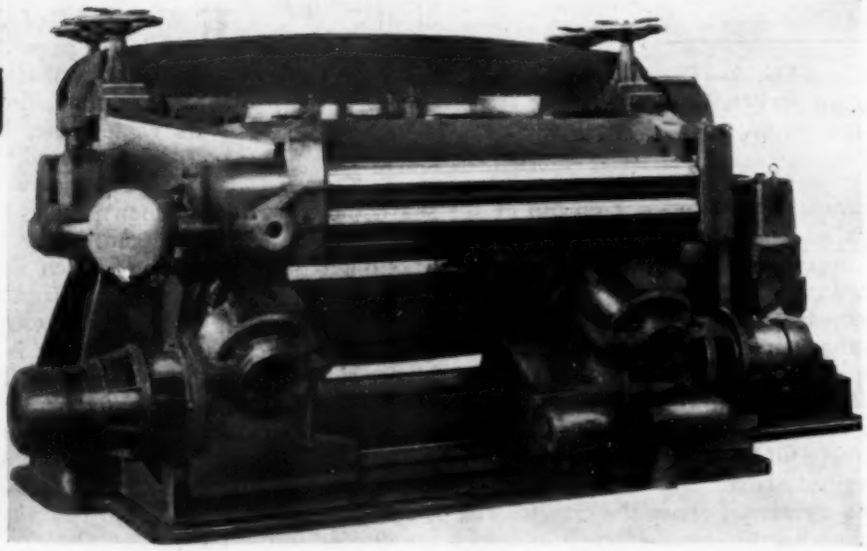
**A motor suspended from the ceiling, saving floor space and aiding cleanliness and safety, but requiring a rigid mounting and attention to problems of vibration and lubrication. Ceiling mounting sometimes solves the problem of motor protection, since driving units may thus be fully enclosed**





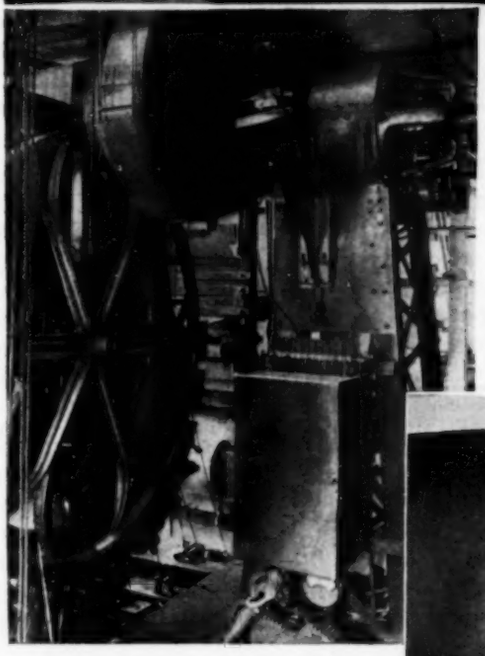
WHERE and how shall the motor be mounted? More elements enter a proper answer to this question than are at first apparent. In addition to the element of simple mounting, first considered, other considerations include: protection of the motor, need for space, convenience, safety, light, cleanliness, and type of mounting. The need for applying power as near as possible to the driven unit is a paramount consideration. On these pages are shown several types of motor mountings, some common, others uncommon, but each adapted for its particular use.

**An adjustable-speed direct-current motor mounted on the crossarm of this radial drill makes it easy to drive the drill at any desired speed without a mass of external mechanical speed-changing equipment. This aids portability**

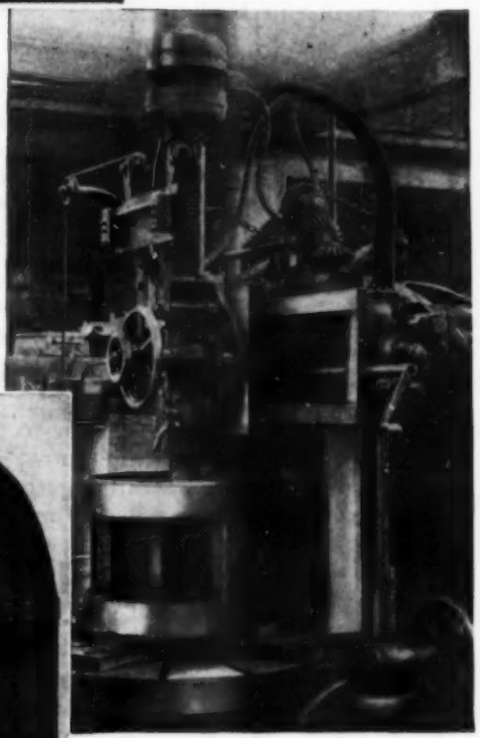


**Motors mounted as close as possible to the driven unit simplify power transmission. Here ring bases are used for mounting some motors, even in horizontal positions. Maintenance is simplified through elimination of power transmission devices**

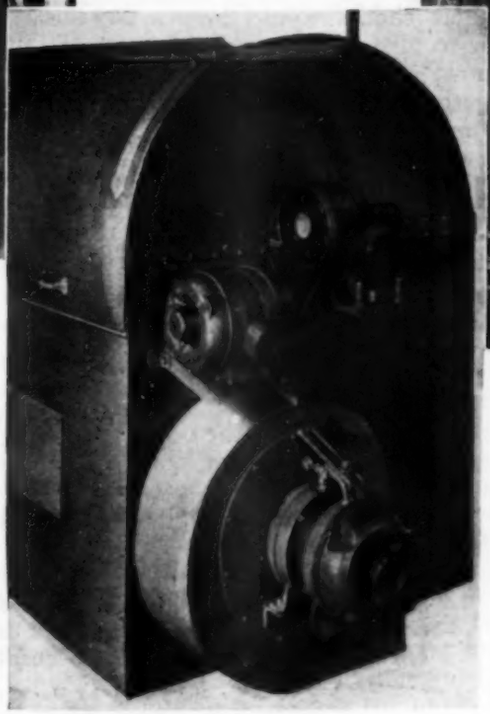
Individual motor drives may be applied easily to units originally designed for lineshaft drives. The end drills use simple shelf-type mountings equipped with several holes to permit motor alignment. The middle unit uses motor weight to keep driving belts taut. The vertical motor is ingeniously mounted, for it not only drives the drill but also the oil pump through a double-shaft extension



A pair of unique mountings on a laundry tumbler. The upper is adjustable to change belt tension; the method of mounting the lower provides adjustment for aligning the motor with the driven shaft



An unusually high steel-frame mounting for a motor to drive a textile machine. Other similar types might be built of boiler plate on wood bases, of brick, or of concrete where no vibration is desired. Occasionally a group of machines are individually driven from motors mounted on one platform, thus simplifying maintenance and operation and reducing mounting cost



Mounting a motor directly on the vertical column by means of a bracket aided in turning this old boring mill into a vertical grinder. Power is transmitted by means of a shaft through the column, lessening transmission difficulties and applying power near the driven unit

# The Foreman's Round Table

## WHO PAYS THE BILLS?

NOON hour was about half gone when Ed entered the lunch room and looked around for his friend Al, who had promised to wait for him.

Al spied him first and hailed him. "Hey, big boy, come over here. Unload your feet and tell me what's on your mind? It takes something mighty important to keep you away from the trough. Come across."

"Oh, I've been trying to straighten out the tool crib situation in my department. It's in a heck of a mess."

"How come?"

"I told you we were having trouble with tools not being taken care of, didn't I? Well I put another man in and he had the mikes repaired, the taps and reamers ground and things like that. Now you can get a drill with a whole tang on it and a reamer that is to size and that will cut."

"I can't see anything to worry about in that," interrupted Al.

"Wait until I finish, then and you will. I posted a notice that new checks would be issued and for everyone to turn in what tools they were not using now, and Friday night to turn them all in together with their extra checks. The crib tender came and told me that old man Mason was shy a 5-in. mike and the 1½-in. set of hand taps."

"Well, what of it? No one is accusing old Dan Mason of stealing them, is he?"

"Sure not! Dan is just a victim of circumstances, but he's got to produce them or pay for them."

"What does Dan, himself, say?"

"Oh, he thinks he remembers lending the mike to Jack Plummer and the taps to Tom Martin, but he ain't sure. And the devil of it is that both of those birds were laid off two weeks ago and they checked out of the tool crib clean."

"They would, Ed. But I don't think either one, would plain steal, and I don't see how they could get away with substitution of other tools with our double-check system. One check is placed on the tool, and the other on the man's number, isn't it?"

"Maybe, but I believe that first crib man neglected it when he was rushed. He didn't neglect it altogether, or poor old Dan wouldn't have been caught. Probably when Martin and Plummer cleared, he just counted the checks on their number book but did not check the tools the checks were against, and they did not turn in the mike."

"That's like every system. It falls down when the incentive or compulsion fails. The double check takes care of substitution, but nothing will cure carelessness or theft except separation from the job, and that cure is only temporary. You have to get a peculiar type of man to be a good tool-crib man. But what did you finally decide to do, make old Dan pay?"

"I didn't decide. I laid all my cards before Williams. Let him worry about it. I did tell him I thought the single check system would be as good as the double, now that I've got a good crib tender."

"Yeah? and where will you put the check, on the board or where the tool is taken from?"

"Where the tool belongs, of course. That tells the whole story."

"Yeah again. When a man quits and turns in four tools, how are you going to tell that's all he has out?"

"Easy, the cribman will demand ten checks or ten tools."

"If he thinks of it."

**Should workmen pay for tools for which they cannot account? Is there any method better than the double-check system, that is not too cumbersome?**

Suggested by Jack Sargent,
Foreman, R. Wallace & Sons Manufacturing Company.

# ▸ ▸ ▸ Discussion of Former Topics

## Pitiless Publicity

From a study taken in 14 of the larger machine shops in this country, there has been proven a reduction of 45 per cent in the careless and inefficient mistakes made in these shops since the inception of various methods of publishing the shortcomings of the different departments. It is, in my opinion, the most efficient method of reducing carelessness and inefficiency that has been tried to date, inasmuch as no man or group of men wish to be posted on the inefficient side of the bulletin board more than once.

Most executives would object to being judged on their productivity and efficiency, but why should they? They are a part of the shop program and are in a position to make more costly mistakes than the men in the shop. We all hope for the millenium, and some day it will arrive. Then you will see the executive weighed in the same scale as the production force: until then we will have to do our best. Naturally I do not believe that the executives should be "posted" out in the plant. They should be posted in the offices, and when they are, there will be more care taken about orders issued and less guess work.

—Charles R. Whitehouse, *Standards Engineer, The Holtzer-Cabot Electric Company.*

## Bad Debts

The attitude of Williams on forced debt collection through the company is absolutely sound and unassailable. The company is not interested in how the tradesmen collect their bills. The whole question is almost entirely the fault of the tradesmen. Of course there are deadbeats in every community, but their identity is generally very easily established. Most of the bill owers are led into debt. They are strongly urged to buy through high pressure selling methods. A stirring appeal is made to them and always capped with the climax, "Just charge it." This sort of thing always means slow collections. Then the creditors want the employers of the men to help them overcome their own lack of good business judgment by collecting the bills. This condition is not right.

—L. O. Brown.

## Tolerances

My experience with the adjustment, operation, and repair of thousands of machines of hundreds of types has led me to the following conclusions:

1. Only a small proportion of parts are actually made within the tolerances generally supposed to be necessary for the class of fit.
2. If suitable means of adjustment are provided where accuracy is essential, the average deviation from the tolerances shown in the published tables does not interfere seriously with the efficiency of the machine.

In general the standards of accuracy attained are lower than those set by theorists, lower also than those which manufacturers claim to attain, but if the design is good the difference in standards is unimportant in practice.

There are experts who, having spent years in research work, have given us tables of fits, limits and tolerances. Engineers and draughtsmen have, quite rightly, accepted their dicta and embodied their recommendations in designs. Machine-tool builders claim that the tools they offer for sale will produce work to those limits. They seldom take into account the difficulties and reservations not shown in the tables. There is no doubt that the limits can be worked to, but in many cases not economically except on parts where the dimensions in question are the result of a single operation. These limits are therefore generally regarded by the shops and inspectors alike as ideals to be aimed at rather than as standards to be attained.

—H. J. Burnham, *Birmingham, England.*

## The Cost of Quality

Undoubtedly quality is, in many instances, overemphasized, but surely the remedy is not had to find. The correct standard of quality is the lowest consistent with 100 per cent efficiency. A great deal of unnecessary machining is done. A larger tolerance could be allowed where close fits are not in question. All machining for appearance sake only should be ruthlessly cut out. When a large order has been received, one article should be made, submitted to the customer, and any required adjustment in quality and price made. When the standard has been agreed upon, that article should be kept for comparison with the bulk, thus obviating any dissatisfaction on the part of the customer.

—Herbert C. Gibling, *Southern Railway Works, Brighton, England.*

## "Rules is Rules"

To my mind Williams' interpreting rule tends to amplify those that preceded it, rather than to nullify them. A rule is only, after all, an indication of the most desirable thing to "shoot at" under normal circumstances. It is a sign-post along the road of industrial progress, not a rut so deep that there is no escape. If business could be reduced to a mere matter of rules, we would need far fewer executives than we have today in industry. Frankly, I believe the real function of a live and honest-to-goodness executive is not to enforce rules, but rather to break and circumvent the rules as necessity dictates.

I believe such a provision as Williams has made is good management. In fact, I believe it should hardly need such definite expression, but should have been regarded as implied by the foremen. No man can evolve a rule that represents the best action to be taken under

all circumstances, and therefore it is understood that the authority to interpret them according to circumstances is delegated to the executives who are on the spot. Naturally, the breaking of rules requires judgment and thought, but that is what executives are paid the higher salaries for. —CHARLES E. KIRKBRIDE, JR.

## The Stork's Assistant

Compulsory medical examination is based on a sound premise, and it might well be extended, provided something was first done to educate doctors into a more liberal interpretation of its principles. As it now is practiced in many instances, it is too much of a mass production proposition, with the same degree of physical vigor and health expected of a clerk as of a blacksmith.

I believe the certificate of any physician should be accepted. If he is a quack, the medical associations will soon ferret him out. The family physician is often in a better position to understand his patient's health, than is a company doctor with a single routine examination.

I believe that, in general, six months elapsed time between examinations would be reasonable, except that for clerical or office forces this might well be extended to a year. On certain hazardous work dealing with gas fumes, chemicals, high pressures, etc., the period should be considerably shortened, until it is conceivable that, in an extreme case, it might become biweekly.

—D. R. WATSON.

## Wide Open

Having used both desk and office, I would declare against the desk, though it might do for a chargehand. It is unnecessary for a foreman to be kept on his toes constantly, or to watch men all the time, or be seen every time a man turns around. The foreman has something else to do besides act the part of gaoler or slave-driver.

While the open office has the advantage of accessibility, freedom from obstructed view, and less stuffiness than the closed office, its disadvantages outweigh its advantages. Exposure to noise during telephone messages, liability of being overheard, exposure of papers and messages, and the lack of privacy and comfort during interviews and lunch hour all make the open office objectionable. —WILLIAM BRYCE, *Sheffield, England.*

## Whistlin' Willie

Twenty years ago when I entered my present place of employment I was given a book of rules by the foreman. This book told me how to govern my conduct if I expected to retain my position with the concern.

Whistling and talking during working hours was prohibited. The owner of the concern was a strict disciplinarian, and the foremen acted as policemen to see that the rules were not violated. Production costs were stabilized. An employee was prohibited from earning more than a stipulated sum, and he did not dare make less. Almost military discipline obtained.

Came the war—increased help required, labor more mobile, restriction on the amount that a man could earn removed. Result: an increase in production, cheerful workmen, men singing or whistling at their tasks, accepting correction from their neighbors who might be annoyed by such exercises.

The effort required to sing or whistle at a task in no way detracts from the energy required to perform the task, as singing and whistling are often done unconsciously, and if anything, have a stimulating effect, rather than the reverse.

It is the natural expression of a man with whom all is well: it is a sure sign that he has his task well in hand, and that he is capable of a more exacting task.

—FRED KAY.

## Age and Its Compensations

The one determining factor affecting wage rates should be skill and initiative. Experience, age, seniority, and knowledge are of no value unless applied, and their applications are most apparent in skill and initiative.

For the sake of the steady, plodding type of mechanic, there should be a minimum wage, but beyond that, increases should depend on individual achievement. As an example: Through some error which was not detected until the job was finished, a large number of gear wheels required reboring. The job was given to machinist A, of the steady, plodding type, on the only lathe available, possessing an independent four-jawed chuck. Each gear was set true to the existing bore and then brought to size. To facilitate output, later in the day machinist B, who possessed skill and initiative was called into service. He quickly realized the slowness of the operation and asked permission to open out the bore of chuck from the existing $6\frac{3}{4}$ in. to 7 in. (the diameter of the gears) for a depth of $\frac{1}{2}$ in. to act as a locating pocket. In all probability, machinist A would never have thought of this if he had done the whole 600 gears. Machinist B, proving his ability over the former, should have a higher wage rate. —R. G. HEWITT, *Keighley, Yorks, England.*

## Direct Action

All divisions of an organization are important. The sales, financial, and production departments must carry out their duties properly or the entire organization will suffer. A chain is no stronger than its weakest link, and a weak department will make it harder for the others to function properly.

The general manager is responsible for the functioning of all parts of the company. When information is needed he wants it direct from the man who knows all about it. During conferences it is always a disadvantage for one member of the group to be of lower rank and with little or no authority as compared to the others.

At times it is necessary for an organization to have separate plants. For the sake of efficiency and morale it is best to have the man in charge known as the superintendent reporting directly to the man in charge of all production, who should have the title of general superintendent.

Most men respect titles. By delegating the various duties of the divisions to the proper man and then giving this man some title that will command the respect of the other employees, whether they are of lower, equal, or higher rank, the work will progress smoothly and efficiently. —E. F. WERNER, *Superintendent, American Fixture & Showcase Company.*

# Form Grinding
# In Successive Operations

WILLIAM C. BETZ
*Master Mechanic, The Fafnir Bearing Company*

IN precision tool and die making, form grinding has helped to produce accurate shapes with a very fine finish on hardened steel, a finish which could not have been duplicated without a great expenditure of money.

Probably the simplest type of form grinding may be found in the circular and shaving type of form tools used on automatic screw machines. This class of tool is generally made of high-speed steel, and because of the high temperature of heat treating, is liable to distortion, surface defects and soft skin. Any and all of these

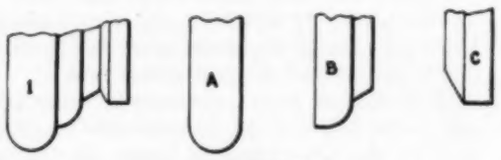



FIG. 1

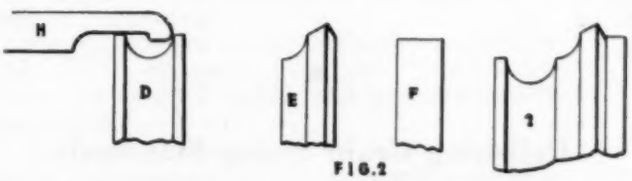



FIG. 2

**Fig. 1—Form grinding a tool for an automatic screw machine, using three separate wheels. Fig. 2—A cutter similar to Fig. 1 with concave radii also ground with three wheels**

defects can be corrected by form grinding, and the method is not complicated nor very expensive.

To form grind economically, one must get wheels that are suitable for the work. They must be fine-grained, hard enough to hold a form, and free-cutting, so as not to burn the work. For roughing, on machines using wheels from 7 inch to 12 inch diameter, grains from 80 to 100 and grades from H to J are recommended. For finishing, grains 100 to 150 and grades from J to M. All grinding should be done wet if possible, but dry grinding will produce good work, given reasonable care.

To form grind, it is not necessary nor desirable to finish the form part with a wheel that covers the whole piece. It is better to grind various ribs and projections with narrow wheels, matching one diameter or height with one previously ground. In this way, forms of great width can be ground accurately because the necessary wheel shapes can be easily produced.

Let us assume that we wish to grind a form tool like that in Fig. 2. It would be possible to true a wide wheel to grind this form by the aid of the radial truing device Fig. 3 and the angular fixture Fig. 4, but it would be difficult to find wheels in the smaller diameters which would be wide enough, so that it is better practice to grind this form in three stages: first, the semicircle *A*, Fig. 1, then quadrant *B* and the first angular section, and last, angle on *C* and the other straight section. The height of the last section can be very closely governed by the use of the graduations of the cross-slide dial when truing the wheel.

Now suppose we had to true the wheel like that in Fig. 2 to grind a form as at Fig. 1. We would find it a very difficult matter to true the wheel to the center of the radii on both the semicircle and the quadrant, due to interference of the diamond holder with these radii. The truing device could not be swung through an arc of 180 deg. because of this interference, but by making the form with three wheels as at *d*, *e* and *f*, the job may be accomplished without trouble.

In using this method of finishing hardened pieces, the wheel-truing devices used fix the measure of success. A radial truing device like that in Fig. 3 is indispensable for truing a wheel to both male and female radii. If the diamond point is back of the center of fulcrum, a male

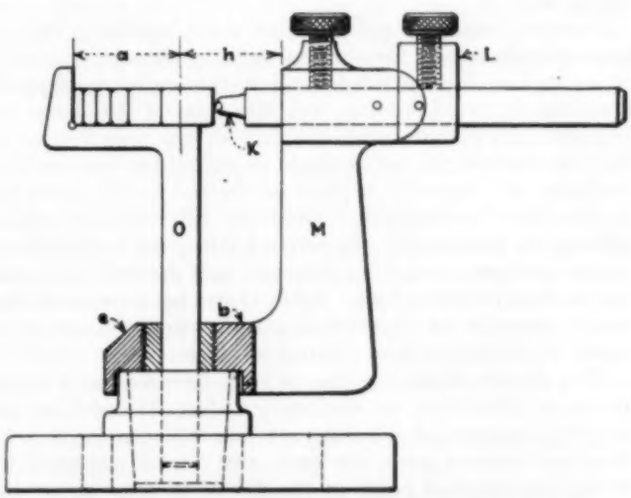



**Fig. 3—Radial wheel truing fixture for both concave and convex radii. The diamond is set by means of gage blocks**

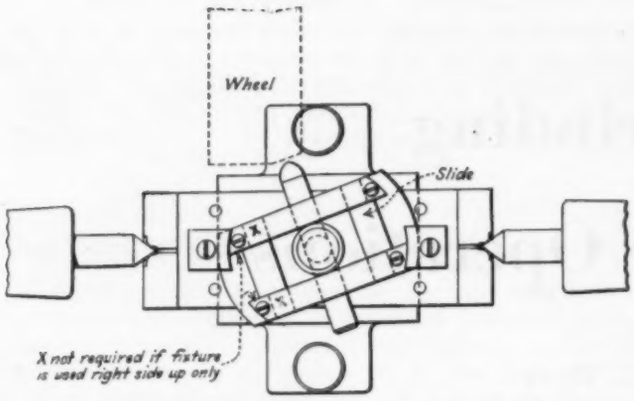



**Fig. 4—A truing fixture for bevel surfaces. This device can be used on centers, or platen, or either side up**

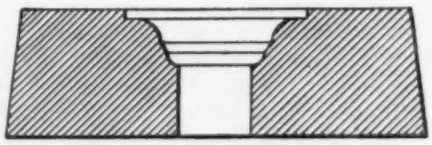


**Fig. 5—An example of form grinding with several wheels**

radius is produced, if in front of fulcrum center, a female is produced.

By the aid of the bracket *O*, Fig. 3, and a set of accurate-sized blocks, radii can be produced on a wheel accurate to 0.0001 inch. In making this device care must be exercised to see that the standard is an accurate fit in the base. The taper should not be so slight that it will wedge, nor so obtuse that it might ride on the oil film when being swung from right to left. I have found that tapers from 3½ to 5 deg. included angle give the best results. In making bracket *O*, it is best to have the distance *a* long enough to accommodate a number of blocks, as then inside and outside radii may be measured with Jo blocks to 0.0001 inch from zero to the capacity of the device. Another thing to take into consideration is the height of the frame from the top at *b* to the center of the diamond *k* in relation to distance *h*. If *h* is deep and height *b-k* is short, large-diameter wheels cannot be trued to the extreme capacity of *h*, because of interference of the wheel with the outer portion of the frame at *e*.

Another important part of this fixture is collar *L* which is used when setting for concave radii. After the diamond is set to the desired inside radius, this collar is slipped onto the diamond-holding rod, the face of the collar is brought into contact with the end of the arm trunnion and the line on the collar made to match the line on the trunnion and fastened in place on the rod by the screw in *L*. In order to remove *O* from the fulcrum stud when setting for inside radii, the screw holding the rod in place in the swinging arm *M* is loosened and the rod with collar in place is drawn back. After *O* has been removed the rod is brought to its original position and the screw is again tightened to hold the rod in place.

The device shown in Fig. 4 may be used on a lathe or on a cylindrical or surface grinder. If used on an external cylindrical grinding machine the fixture is held between centers with the rear arm screw adjusted to bring the diamond point of the device to dead center by the aid of a spirit level placed on the top of the slide and with the front screw adjusted to take up all slack between front and back. This device is used for truing straight angular shapes on a wheel. The slide is set by the aid of a bevel protractor.

To use this device on a surface grinder the plates making the pedestal arms *P* are removed, and the fixture is bolted to a hollow angle block or angle iron which in turn is held by either a magnetic chuck or bolted to the machine table. Truing may be done from either bottom or side center of the wheel.

In connection with form grinding, one should have at least a dozen wheel mountings to avoid the necessity of disturbing the wheel setting after each section has been ground. In this way, a wheel trued to a given shape may be used many times without retruing, saving time and wheel life.

Small wheels used on internal grinders must be retrued often to produce exact shapes in the work.

Formed milling cutters and taps may also be successfully ground. For formed milling cutters, comparatively small diameter wheels must be used, as a large wheel is likely to interfere between clearing the heel of a tooth and the face of the next one. This can only be determined by a layout of the work and wheel.

Threads can be successfully ground on an engine lathe using the angular truing device, Fig. 4, to keep the wheel at the proper angle. To use it for thread work, a pair of auxiliary slides *x*, is added to the angle slide plate to hold the slide down so that it may be used either right or wrong side up, between centers to true both angles of the wheel by simply swinging the fixture 180 deg. on its centers, bringing the slide angle right and left with one setting of the slide. It will be noted that swinging the fixture does not change the position of the diamond center, as this is placed on the exact center line.

In grinding threads great care must be taken to set the center line of the wheel at the correct helix angle, and the center line of the wheel spindle must also be on dead center with the height of the lathe centers, otherwise the faces of the thread will be distorted and the angles will be off.

■

## Polishing Grain Sizing Standards

MASTER SAMPLES of aluminous oxide polishing grain will be available shortly, these being planned to help eliminate difficulties formerly encountered in checking sizes by consumer and producer. They are the result of a meeting in September, 1930, of a committee of representatives from the larger artificial grain producers. This committee authorized the Abrasive Company to produce master samples for checking all grain sizes and particularly the new sizes conforming to General Motors Corporation specifications as outlined tentatively by N. S. Mosher of the Chevrolet Motor Company. At this same meeting, a research fellowship was established at the Bureau of Standards in Washington for the purpose of analyzing problems and eliminating difficulties encountered in producing the master samples.

Production of the master grain samples is being done by Research Associate Sveshnikoff of the Bureau of Standards, co-operating with the Abrasive Company. Then it will be a simple matter to calibrate sieves, and grain will be produced to a set standard with such a degree of accuracy that problems of securing the proper size will be largely eliminated.

# Comparisons of Piston Practice

**The sequential operations of three representative cars show how the sales price is reflected in the machining cost**

**A. P. GWIAZDOWSKI**
*College of Engineering, University of Michigan*
*Professor*

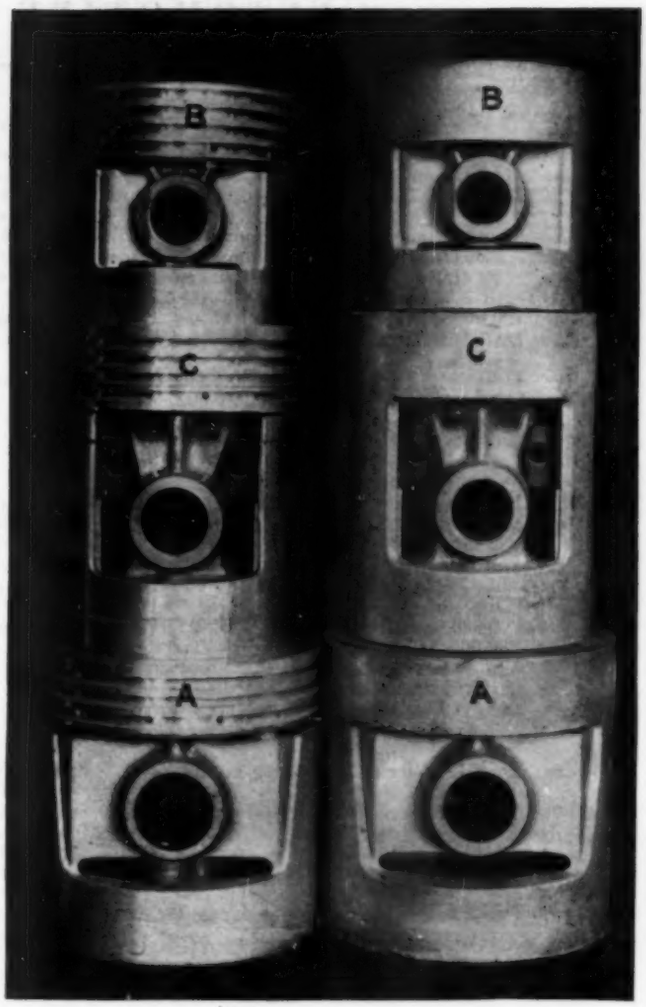
THE automotive industry rediscovered and stimulated the development of the manufacture of interchangeable parts. The beginning of a real expansion of the automotive industry dates from 1910. The progress made during this short period in the organization, production, distribution and service is tremendous. The design of drill jigs, work-holding fixtures, multiple-purpose tools, together with the use of the combined and multiple cuts, was developed by the automotive manufacturer into a tremendously important part of production engineering.

The demand for higher production resulted in the revision of speeds, feeds and depths of cut. Cemented tungsten carbide and tantalum carbide were produced.

The term "manufacture of interchangeable parts" means the machining of the component parts of a device so that any two mating parts will assemble together. For example, any one of several thousand cylinder heads will assemble to any one of several thousand cylinder blocks for the same make and model of engine, regardless of when or where each part is made.

The analysis made of the tooling methods of six leading manufacturers of automobiles, ranging in prices from $475 to $6,000, shows that this branch of production is well standardized. In almost every case the methods of originating and designing tools are similar or exactly the same. Whenever a decision is needed in tooling automobile parts, the same factors are discussed and the same methods are followed in the execution of the decision. The companies involved seemingly have no thought of using the suggested equipment formulas or of developing their own formulas for the more economic production of auxiliary devices and tools.

Recently, engineering drawings, operation sheets, and the actual time for each operation on the pistons of six leading automobile manufacturers were analyzed and studied carefully. By a process of elimination, three pistons were selected as representative: one from a four-cylinder car, and two from six-cylinder cars. For the sake of simplicity, let us call the manufacturer of the four-cylinder car "A"; the manufacturer of the cheaper six-cylinder car, "B"; and the producer of the higher priced six-cylinder car, "C."




**Piston A requires 14 operations and is completely finished in 2.58 minutes. B is also finished in 14 operations, but takes 4.55 minutes. Piston C is finished complete in 30 operations, which, combined, take 14.01 minutes**

The analysis of the aluminum alloy used by the majority of manufacturers is as follows:

| | |
|---|---|
| Aluminum | 88.75 per cent |
| Iron | 1.25 " " |
| Copper | 10.00 " " |

Brinell hardness ranges from 125 to 160

Manufacturer "A" specifies pistons in a more positive manner. Metal used in pouring piston castings must consist of not less than 50 per cent of 99 per cent virgin aluminum alloy, not more than 5 per cent mis-run piston castings, and not more than 45 per cent gates and risers from piston castings. The analysis of the casting must be as follows:

| | | |
|---|---|---|
| Aluminum | 87.00 | per cent minimum |
| Copper | 9.25 to 10.75 | per cent |
| Iron | 1.00 | per cent maximum |
| Magnesium | 0.15 to 0.35 | per cent |
| Silicon | 0.50 | per cent maximum |

Brinell hardness ranges from 95 to 126

| Oper. No. | Manufacturer "C" | Manufacturer "B" | Manufacturer "A" |
|---|---|---|---|
| 1 | Rough face open end to $4\frac{1}{32} \pm .010$ from dome and bore center to $2.980 \pm 0.000$-$0.005$ dia. and center closed end | Face bottom, rough bore, and chamfer open end and center head, bore to 2.657-2.659. Leave $\frac{1}{32}$ stock on bottom for finish face | Bore skirt and face open end |
| 2 | Rough turn skirt and ring lands to $3.247 + 0.005$-$0.000$ dia., rough face head to $\frac{9}{32}$ dim. and rough turn 4 ring grooves to $2.913 + 0.010$-$0.000$ dia. x $\frac{3}{32} + 0.005$-$0.000$ in. wide | Rough turn O.D. Face head and chamfer bottom. Turn head dia. to 3.145-3.135 in. Turn skirt dia. to 3.175-3.165 in. Leave $\frac{1}{32}$ stock on head for finish face | Rough and finish turn skirt and ring grooves, finish face top and chamfer |
| 3 | Drill four $\frac{3}{16}$-in. holes, two in each piston pin boss | Drill four $\frac{3}{32}$-in. angular holes | Rough grind O.D. and relief pass |
| 4 | Drill $\frac{3}{32}$, bore $0.856 + 0.000$-$0.002$ and rough ream $0.866 + 0.000$-$0.002$ and cut two lock wire grooves $\frac{3}{64} + 0.005$-$0.000$x0.039 rad. x $1\frac{13}{16} + 0.010$-$0.000$ dia. and finish ream $0.872 + 0.000$-$0.002$ diameter | Drill $\frac{3}{32}$-in. hole in skirt | Drill and rough bore pin hole |
| 5 | Blow out both ends with air | Mill 1 vertical and 2 horizontal slots | Burr both sides of pin holes |
| 6 | Semi-finish. Bore center in open end to $2.990 + 0.000$-$0.005$ diameter | Blow off with air | Drill oil holes (2) in piston pin boss |
| 7 | Finish turn skirt to $3.205 + 0.002$-$0.000$ dia. 1st land to $3.181 + 0.000$-$0.003$ dia. 2d and 3d land to $3.181 + 0.000$-$0.003$ dia. 4th and 5th land to $3.147 + 0.000$-$0.010$ dia. Semi-finish face head to $2.505 + 0.005$-$0.000$ dim. and finish skirt to $1\frac{3}{4}$ dim. Cut an oil groove on O.D. of skirt $\frac{1}{16}$ wide x 0.020 deep and 1 on No. 4 ring land 0.050 widex0.025 deep | Drill, rough ream, and finish ream wrist pin hole. Rough ream, 0.802-0.803 in. Finish ream, 0.808-0.809 in. | Drill twelve smoke holes |
| 8 | Drill 12 holes in No. 4 ring groove | Rebore, chamfer, and finish open end of skirt | Balance |
| 9 | Chamfer cross bore hole and cut lock ring groove | Semi-finish turn O.D. Finish face and chamfer head. Turn top land to 3.101-3.098 in. Turn 2d land to 3.111-3.109 in. Turn skirt to 3.1415-3.1385 in. | Saw $\frac{1}{16}$-in. slot in skirt, and stamp "front" |
| 10 | Saw two slots $\frac{3}{64}$ in. wide below lower ring groove | Rough and finish turn ring grooves and turn 4th land to 3.075-3.065 in. | Finish grind O.D. and relief |
| 11 | Face off center boss and finish face head of piston smooth to $2.500 + 0.000$-$0.002$ dimension | Drill smoke holes | Rebore and finish bore pin hole |
| 12 | Cut lower oil groove on O.D. of skirt 0.020 in. deep x $\frac{1}{16}$ in. wide | Remove burrs from smoke holes and blow off with air | Burr ring grooves |
| 13 | Semi-finish, align, ream piston pin hole to $0.8741 + 0.0005$-$0.000$ diameter. | Finish turn skirt | Wash |
| 14 | Blow out chips | Repair, if necessary | Inspect and weigh |
| 15 | Finish cut center in closed end of piston | | |
| 16 | Saw long vertical slot at 4 deg. angle in skirt | | |
| 17 | Blow out centers | | |
| 18 | Finish bore center to $3.000$ in. $+ 0.002$-$0.000$x30 deg. angle | | |
| 19 | Semi-finish turn first two ring grooves to $0.115 \pm 0.001$x$2.897 \pm 0.005$ dia. the 3d and 4th ring groove to $0.115 \pm 0.001$x $2.872 \pm 0.005$ diameter<br>Finish turn first two rings grooves to $0.126 + 0.0002$-$0.0005$ in. x $2.882 + 0.000$-$0.010$ diameter. 3d and 4th ring groove to $0.126 + 0.0002$-$0.0005$ in. x $2.856 + 0.000$-$0.010$ diameter | | |
| 20 | Blow out chips both ends | | |
| 21 | Rough grind skirt to $3.195 + 0.001$-$0.000$ and rough grind 1st land to $3.176 + 0.000$-$0.003$, 2d and 3d to $3.176 + 0.000$-$0.003$ in. | | |
| 22 | Burr ring grooves and skirt at both ends and form radius on end of skirt | | |
| 23 | Blow out chips both ends | | |
| 24 | Semifinish grind skirt to $3.190 + 0.001$-$0.000$ dia. Finish grind ring lands 1st land to $3.171 + 0.000$-$0.003$; 2d and 3d land to $3.171 + 0.000$-$0.003$; 4th and 5th land to $3.137 + 0.000$-$0.010$ in. | | |
| 25 | Finish grind skirt to $3.186$ in. $\pm 0.001$ dia. at top end of skirt and grind oval at bottom end of skirt to $-0.001$ to 0.002 in. smaller at dim. "B." | | |
| 26 | Remove burrs and scrape sharp edges | | |
| 27 | Finish line ream piston pin hole to size $0.8753 \pm 0.00015$ diameter | | |
| 28 | Wash in olium spirits, blow off, and wipe dry | | |
| 29 | Remove chips from twelve drilled holes in No. 4 ring groove | | |
| | Inspect, stamp letter, weigh, grade, count, and place in container | | |

The same foundry furnishes rough castings to the three companies. The main machining processes are the same, but the number of operations used by the individual manufacturer and the time spent in performing those operations are different.

Manufacturer "A" uses fourteen operations to completely machine the piston, and the time from floor to floor is 2 min. 35 sec.

Manufacturer "B" closely follows manufacturer "A," with fourteen machining operations also, but the time taken to perform those machining operations is 4 min. 33 sec., or almost double the time set by "A."

Manufacturer "C" evidently follows closely the first law of tool engineering, "the sub-division of operations is a function of accuracy," since he performs thirty operations in machining the piston as against fourteen in the case of "A" and "C." The time of machining one piston from floor to floor is 14.01 min.

Comparative operation sheets of the three manufacturers, designated by "A," "B," and "C," are given:

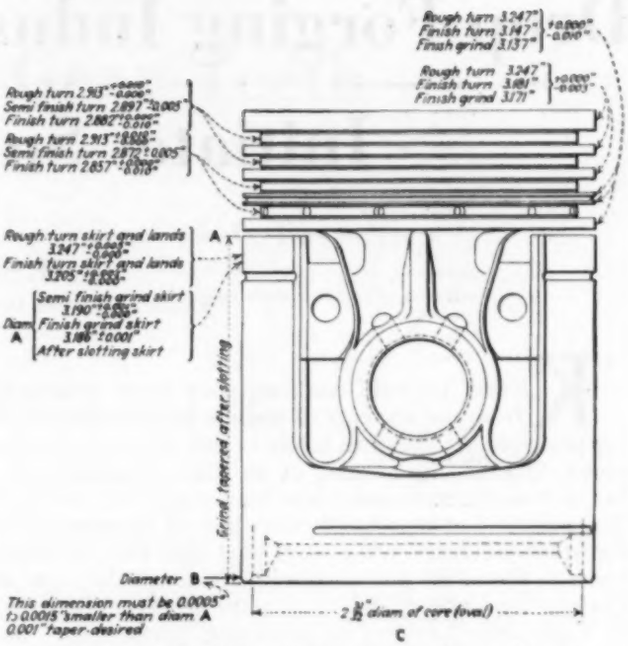
One is not justified in drawing conclusions as to the reason or justification for the great differences in time shown. Part of the difference may show up in the lasting qualities of the car, part may be because of the difference in quantity of output, and still another part may be due to a difference in tool engineering ability.

The differences in time illustrate the cost of refinements. A piston is a small part of an automobile, but if the same ratio held throughout and it were assumed that the "A" automobile sold for $500, "B" should sell at $881, and "C" at $2,715, on the basis that the same ratio of labor expense had been used throughout the entire car. This would not take into consideration any difference in the overhead rate, so the comparison as a whole means little. The real answer in my estimation lies in the difference in the tool-engineering policy of the manufacturers. Manufacturer "A" maintains a permanent tool-engineering department. It is kept busy between new models in working out new combinations, sequences and improvements. Manufacturer "C" maintains practically no tool-designing organization. Most of his tools are designed by job shops. Manufacturers in general are divided as to the merits or demerits of this method. Some claim that the job-shop designer cannot visualize the conditions under which the part is actually manufactured, and is hence at a disadvantage. Others claim that the job-shop designer has a broader view of production methods because he designs for many manufacturers of the same class of product and also for many different products.

On the other hand, the enemy of efficient manufacture is tradition, and any product that has an established clientele is apt to cling to the methods that have built up its reputation. Where such practice adds cost without compensating values it cannot be justified.

Precision and finish is another important factor. Some engineers attach tolerances to the dimensions, disregarding the production facilities of the plant and the commercial requirements. The comparison of the piston drawings does not show very much difference in tolerances. The finish of the product, studied with a magnifying glass, does not show any difference.

Hand operations are detrimental to low costs of production. Manufacturer "C" blows out chips five times at an expense of 0.32 min., and removes burrs three




**The piston of a high priced "reputation" car. Many refining operations are added**

times, using 2.35 min. for these operations. Manufacturer "A" completes the entire machining of the piston in exactly the same time, or manufacturer "A" performs nine machining operations, washes, weighs, stamps, inspects, and balances the piston, while manufacturer "C" is removing burrs. Tooling is, perhaps, the most important factor in this case.

Manufacturer "A" has a heavy production, and his tools are excellent from the point of design as well as from the manufacturing point of view. Single-purpose machines and the expensive auxiliary devices, such as jigs, fixtures, gages, and special tools predominate in his plant. Manufacturer "B" is imitating "A," possibly unconsciously, in tool engineering methods, but is relatively a small producer, hence his tool equipment, though efficient and effective, cannot compare in quality with that of manufacturer "A." The ingenuity of the tool engineer of manufacturer "B" and his staff succeeded in reducing the time of piston production to 4.55 min. each. Manufacturer "C" has no tool engineering organization to speak of. The tools are largely designed and built by job shops.

Manufacturer "A" keeps the tool engineering department intact, even during slack periods. Toolmakers, diemakers, and production men are encouraged to suggest new methods or ideas for improving the existing production methods. All these new ideas and suggestions receive proper consideration and are paid for, if adopted.

From the above facts, the following conclusions seem warranted:

1. Close accuracy of machine parts at low cost demands the highest type of machine tools, auxiliary devices, gages, and small tools.
2. High-grade tooling is advantageous only when the quantity of production is very large.
3. A good tool engineering department will reduce the production costs even with ordinary equipment.

# Drop Forging Industry Initiates Survey of Itself

C. H. SMITH
*President, American Drop Forging Institute*

"KNOW thyself" has long since been summoned from the ancients to become an essential working principle of American business and industry. At the recent Atlantic City meeting of the United States Chamber of Commerce no point was more repeatedly stressed. The necessity of associated effort and of the most exact statistical information are more vital than ever, if industry is to thread its way successfully through the maze of modern conditions. Addressing the meeting, Secretary of Commerce Lamont, in particular, praised the "fine spirit of cooperative effort" and the "persistent and careful research and study" by means of which American business has been able to meet and solve its many pressing problems. "A most important factor in aiding these developments," he said, "is the growing tendency among the individual units of industry to take into account in their own planning the interest and welfare of their industry as a whole. The development of the American trade association movement has been and will continue to be a very significant influence in the direction of greater business stability."

It is in pursuance of this industrial trend that the drop-forging industry has embarked upon scientific self-examination and a search for a way out of present-day trade perplexities through a cooperative study of its common problems. This survey or special trade census of the industry — its equipment, investment, productive methods and resources—will be conducted by the United States Department of Commerce at the request of the American Drop Forging Institute. The drop-forging industry, like practically all other manufacturing lines, has undergone tremendous expansion in the past ten or fifteen years. This has brought numerous benefits but many problems also, problems involving in many cases new principles in management, engineering, marketing and research. Data compiled for 1925, covering a limited number of drop-forging companies, revealed that the average concern was operating at only about 62.7 per cent of capacity, while in 1928 these same companies operated at barely 66 per cent of maximum. In other words, during these years, which certainly were not below-average business years, the industry had a surplus capacity of 34 to 37 per cent. What is the situation today?

A carefully compiled questionnaire being mailed out to 2,000 drop-forging concerns by the Department of Commerce will seek to find the answer. The survey will consist of two parts, one pertaining to all manufacturers of drop forgings and the other touching upon those manufacturers who sell all or a substantial part of their total output as rough forgings. The principal objects aimed at in the first phase of the survey are:

To determine the relative importance of the different types of forgings produced, such as automotive, airplane, railroad, agricultural implements, motors and engines, machinery and other forgings.

The investment in drop-forging production in 1928, 1929 and 1930.

The total annual tonnage of rough drop forgings manufactured each year from 1925 to 1930.

The number of tons of total drop-forging production which was sold as rough forgings in each of the years from 1925 to 1930.

The capacity of the industry in terms of maximum production of drop-forging tonnage.

A census of equipment, showing both hammers and up-setters of various types, together with the amount of change in equipment in the period of 1928 to 1930.

The second phase of the survey will cover in part such matters as the monthly sales of rough drop forgings for the period of 1925 to 1930; the annual sales for each of these years of the various types of forgings; and the value of the annual shipments for 1925 to 1930 to the various states and sections.

Results of the study will have application in two ways. First, for the individual manufacturer, because he will obtain data by means of which he may compare his own plant and operations with those of other concerns of the industry in his own size group, or with those in the same general geographical location. The second use of the survey concerns the industry as a whole. The pressure and complexity of modern conditions cause many problems which the most efficient manufacturer cannot solve by his efforts alone; for these, group action is imperative.

The questionnaires for the first part of the survey are now being mailed to manufacturers in all parts of the country. Every effort has been made to obtain complete coverage of the industry regardless of trade affiliations. The questionnaire itself was prepared in preliminary draft by the Institute. In its final form it is the result of the cooperative efforts of members of the trade and the Merchandising Research and Iron and Steel Divisions of the Department of Commerce. As rapidly as questionnaires are returned they will be tabulated by the Department, and when complete the results will be subjected to close analysis by the Department's trade specialists. The statistical data obtained upon completion of the study, together with the general conclusions drawn, will be issued in the form of a printed Government report, a copy being mailed without charge to every concern that cooperated in the survey. All individual reports will, of course, be held strictly confidential. No access to returns will be permitted any private agency or a representative of any other government department.

# Surface Hardness of Gear Teeth

**Gear tooth design may be considered from two angles—that of the safe beam strength and that of surface hardness. The author presents a revision of the surface hardness formula**

A. C. RASMUSSEN
*Chief Engineer, Insley Division, National Equipment Corporation*

IN DESIGNING gears the safe beam strength should not be exceeded. To determine this value, the Lewis formula as modified by Barth may be used. The allowable static fiber stress should be taken at approximately one-third the elastic limit of the material. But in many instances, this beam loading is not the limiting condition. The surface hardness of the tooth will govern the permissible load.

Earle Buckingham's book, "Spur Gears," shows the use of the Hertz formula for determining the maximum compressive stress produced at the point of contact of two gear teeth under load. The Hertz formula for two cylinders is:

$$S^2 = \frac{0.35\,P\left(\frac{1}{R_1}+\frac{1}{R_2}\right)}{f\left(\frac{1}{E_1}+\frac{1}{E_2}\right)} \qquad (1)$$

in which:

$S$ = maximum compressive stress
$P$ = load of contact
$R_1$ = radius of one cylinder in inches
$R_2$ = radius of the other cylinder in inches
$f$ = length of contact of cylinders in inches
$E_1$ = Young's modulus for material—first cylinder
$E_2$ = Young's modulus for material—second cylinder.

For two gear teeth in contact:

$\alpha$ = angle of obliquity
$P$ = normal tooth pressure (torque ÷ base circle radius
$W$ = tangential tooth pressure $= P\cos\alpha$
$d_1$ = diameter of the smaller gear or pinion
$d_2$ = diameter of the larger gear
$E_1$ = Young's modulus for the material of the pinion
$E_2$ = Young's modulus for the material of the gear.

The radius of curvature of the tooth profile at the pitch line = the pitch radius of the gear × sin α. This radius is assumed to be the average and is so used in this analysis. The Hertz formula is converted for purposes of gear calculation as follows:

Since $R_1 = \frac{d_1 \sin\alpha}{2}$ and $R_2 = \frac{d_2 \sin\alpha}{2}$

then $\left(\frac{1}{R_1}+\frac{1}{R_2}\right) = \left(\frac{2}{d_1 \sin\alpha}+\frac{2}{d_2 \sin\alpha}\right)$

$$= \frac{2}{\sin\alpha}\left(\frac{1}{d_1}+\frac{1}{d_2}\right)$$

Also substitute $\frac{2}{E_n}$ for $\left(\frac{1}{E_1}+\frac{1}{E_2}\right)$ in which $E_n$ is the value dependent upon the values of $E_1$ and $E_2$ for the materials used. If both the pinion and the gear are made of the same material then $E_n = E$ for the common material used.

From the foregoing, it is seen that $E_n = \frac{2E_1E_2}{E_1+E_2}$

Let $\frac{E_2}{E_1} = m$ or $E_2 = mE_1$

Then $$E_n = \frac{2m}{1+m}E_1 \qquad (2)$$

Making these substitutions:

$$S_2 = \frac{0.35\,P \cdot \frac{2}{\sin\alpha} \cdot \left(\frac{1}{d_1}+\frac{1}{d_2}\right)}{f \cdot \frac{2}{E_n}}$$

$$= \frac{0.35\,PE_n}{f\sin\alpha} \cdot \left(\frac{1}{d_1}+\frac{1}{d_2}\right)$$

Let $N_1$ = number of teeth in the pinion
$N_2$ = number of teeth in the gear
$p$ = diametral pitch
$Q$ = a value dependent upon the number of teeth in the pinion and the gear.

$$d_1 = \frac{N_1}{p}; \quad d_2 = \frac{N_2}{p}$$

and $$Q = \frac{2N_2}{N_1+N_2}$$

$$\left(\frac{1}{d_1}+\frac{1}{d_2}\right) = \left(\frac{p}{N_1}+\frac{p}{N_2}\right)$$

$$= p \cdot \frac{N_1+N_2}{2N^2} \cdot \frac{2}{N_1} = \frac{2p}{N_1Q}$$

Therefore $$S^2 = \frac{0.35\,PE_n}{f\sin\alpha} \cdot \frac{2p}{N_1Q} = \frac{0.70\,PE_np}{QN_1f\sin\alpha}$$

from which $$P = fQ\,\frac{N_1}{p} \cdot \frac{S^2\sin\alpha}{0.70\,E_n}$$

In gear calculations, the tangential tooth load $W$ is used.

Since $W = P\cos\alpha$ and $\frac{N_1}{p} = d_1$

therefore $$W = fQd_1 \cdot \frac{S^2\sin\alpha\cos\alpha}{0.70\,E_n} \qquad (3)$$

$S$ can be taken at 0.75 × the elastic limit of the material. However, it is preferable to take $S$ at a value within the endurance limit of the material. For steels, the safe value of the endurance limit is 0.45 × the ultimate strength. To allow for shock caused by the velocity of impact at engagement, the Barth reduction factor should be used. For accurately machined teeth, operating at a pitch line velocity of $V$ ft. per minute, use a value of 2,400 for $a$ in the following formula:

$$A = \frac{a}{a + V}; \text{ the Barth factor.}$$

In Equation (3) let $M = \dfrac{S^2 \sin \alpha \cos \alpha}{0.70\, E_n}$ (4)

For convenience of calculation, let

$$S_x = \frac{S}{100{,}000}$$

then $M = \dfrac{S_x^2\, 10^{10} \sin \alpha \cos \alpha}{0.70\, E_n}$ (5)

Equation (3) for general working purposes can be written:

$$W = fQd_1MA \quad (6)$$

For both pinion and gear made of steel, machine cut, 20-deg. involute teeth

$$\sin \alpha = 0.3420;\ \cos \alpha\ 0.9397;\ E = 30 \times 10^6$$

$$M = 153\, S_x^2$$

$$A = \left(\frac{2{,}400}{2{,}400 + V}\right)$$

$$Q = \frac{2\, N_2}{N_1 + N_2}$$

$f$ = length of common contact in inches
$d_1$ = pitch diameter of the pinion in inches.

When the pinion and gear are both made of any other material, use the value of $E$ for that material in Equation (2), which in turn, together with the proper value of $S_x$, is used in Equation (5) to determine $M$. Equation (6) for the permissible tooth load $W$ is then solved.

Should unlike materials be used for the pinion and for the gear, $E_n$ is determined by using Equation (2). The value to use for $S_x$ is that of the weaker material, pinion or gear. In all cases $d_1$ is the diameter of the smaller gear whether it is the driving or the driven gear.

# NEW BOOKS

MATERIALS OF INDUSTRY, THEIR DISTRIBUTION AND PRODUCTION—*By Samuel Foster Mersereau, Chairman, Department of Industrial Processes, Brooklyn (N. Y.) Technical High School. Illustrated and indexed. 478 pages, 6x8¼ in. Cloth-board covers. Published by McGraw-Hill Book Company, Inc., 370 Seventh Ave., New York. Price $2.00.*

As announced on the jacket, this work is based upon a high school course which provides a working knowledge of the principal materials of industry, their distribution and production, general properties, transportation, conversion into commercial forms and economic importance. Thus, while it is not an advanced or an exhaustive treatise, the subject matter is well chosen and ably presented; it will be found informative and interesting to almost any lay or industrial reader. In the reviewer's judgment it can be added with profit to public, private and plant libraries.

WHY RECOGNIZE RUSSIA?—*The Arguments For and Against the Recognition of the Soviet Government by the United States. By Louis Fischer. 298 pages, 5x7½ inches. Bound in cloth boards. Published by Jonathan Cape and Harrison Smith, Inc., 139 E. 46th St., New York City. Price $2.00.*

The subtitle of this book is a trifle misleading. It is true that arguments for and against recognition are presented, but the author leaves the favorable arguments to speak for themselves while he devotes his energies to knocking down all the unfavorable ones that he sets up. The result, naturally, is a strong plea for recognition.

Although the book is marred by missing lines and careless proofreading, it runs along smoothly and is easy reading. It is well worth the time of any manufacturer or business man who has taken Russian orders, is wondering whether he should and on what terms, or is undecided whether he should throw his weight into the support of a movement for recognition of the Soviet Government by the United States.

TRENDS IN FOUNDRY PRODUCTION IN THE PHILADELPHIA AREA.—*Research Studies No. III. 75 pages 5½x8½ in. Cloth board covers. Issued by the Industrial Research Department, Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia, Pa. Published by the University of Pennsylvania Press. Price $1.50*

This book is largely a compilation of statistics of foundry production. It deals with prices, output, and ratio of output to capacity. It divides its statistics into jobbing and manufacturing, large and small, city and out-of-town foundries. Steel, malleable and gray iron castings are covered, and attention is given to improvement in equipment, causes of over-equipment, competition, in fact everything but the costs of individual foundries. This book should be useful to all foundrymen.

FACTS AND FIGURES OF THE AUTOMOBILE INDUSTRY (1931 EDITION)—*96 pages, 5⅞x8⅝ in. Paper covers. Published by the National Automobile Chamber of Commerce, Marlin-Rockwell Bldg., 366 Madison Ave., New York, N. Y.*

Just what its name implies, this little book contains all sorts of information about the automotive industry from production of cars in 1930 to the number of miles of highway in the various countries of the world. It is simply the 1931 edition of this annual book of statistics on every phase of the industry, and as such should prove of value to production men, advertising men, statisticians and editors.

# The Tool and Equipment Supervisor, His Organization

**JOHN C. DENSE**
*Tool Engineer, Delco Appliance Corporation*

THE actual processing of operations and equipment is an undertaking of vital importance to the financial success of the company involved. For upon the intelligent and successful completion of this work rests almost entirely the story of cost of the article.

The engineering design of the product is, of course, primarily responsible for the cost. Many times the designing should be, and could be to advantage, done in collaboration with the planning and tool engineering departments.

Processing is not usually considered as a one-man job, being generally done in consultation. This procedure may seem cumbersome and needlessly complicated to one not acquainted with the importance of this work, but it is safe to say that of the number of jobs that are manufactured in any one plant in one year that show a loss, the majority of them are losses because of improper planning, improper design of tools or lack of the proper equipment.

After a process conference, the operation lineup is roughly written, with the operations, machines and necessary tooling noted on the operation sheet. The operation number, operation, deparment number, machine, and tools required are filled in, the remainder of the information being left to be taken care of when the lineup is completed.

The matter of avoiding duplication of tools is a matter to be seriously considered. The only way to avoid this dupilcation is to have a cross file in the tool engineering department wherein tools are listed by name and segregated as to size and style with the proper designations. This makes the finding of tools available for use on new work easier for the processing engineer.

After investigation has shown just what new tooling is necessary for the particular work in question, the processing department writes up the Special Tool Design Order Slip, shown in Fig. 3, and this, together with a copy of the operation sheet, is turned over to the tool engineer for his authority and guidance in designing the tooling.

At this time a copy of the roughly drawn operation sheet is also given to the equipment engineer for his guidance in getting machines ordered, if necessary, and layouts made for arranging them in their proper positions, also that the necessary equipment, such as carrying trays, conveyor systems, etc., may be planned for in advance.

| DATE ISSUED 3-2-28 | TOOL DRAWING REQUISITION | PART NO. 25437 |
|---|---|---|
| APPROVED J.E.B. | | TOOL NO. T-5691 |

PART NAME Back Frame

TOOL NAME Drill Jig

Drill 4 holes 3/16 dia. & 5 holes #47 Drill

MACHINE Natco Multiple Drill- 12" Round Head.

OPERATION Drill all holes in tab & front sides.

DESIGNERS NAME J. Carney DATE FINISHED 3-6-28

Fig. 3

All of this information concerning tool numbers, machine names and numbers and equipment data is returned to the processing engineer to be incorporated in the finished operation sheet. It is necessary that there be some method of keeping the processing engineer advised when tooling is completed and available for new jobs, so that operation sheets may be gotten ready and issued to the factory.

The operation sheet may be duplicated in one of several different ways, such as blueprinting, mimeographing, etc.

The distribution to the factory is an important job and should be carefully done, especially in the case of changes. New sheets should be placed in the several departments and the obsolete ones taken away by a representative of the processing department.

No system of assuring that this is done is too strict, considering that the operation sheets are the final word as to methods and means of producing work. Unless they are so considered they are valueless.

There must be a definite rule that no work is to be done contrary to the operation sheet. This is the only way in which the processing department can keep up to date, and it is important that it keep up to date where the standard cost system is used.

Requests for changes in operations which come from the factory should be made out on a form similar to that in Fig. 4, and sent to the processing engineer who should make arrangements to care for these changes without delay. This is the only way in which the planning department can hold the confidence of the factory.

The work of processing is necessarily done in close contact with the cost department and with the standards or rate setting department. A close connection is necessary here because these three departments are so closely allied that much information is constantly needed by some one of them from one of the others.

CHANGE REQUEST

DATE 4-6-28 OPERATION SHEET PART NO. 26931

PART NAME Coupling

UNIT NAME Water Pump

NATURE OF CHANGE Add Burring Operation

REASON FOR CHANGE

Necessary to remove burr left by milling operation

PROCESSING ENG. J.E.B.

STANDARDS DEPT. W.L.R.

PROD. DEPT. M.F.S.

INSPECTION DEPT. E.C.W.

COST DEPT. R.B.W.

REQUESTED BY B. Jones. TOOL & EQ'T. SUPER. M.R.S.

Fig. 4

Fig. 5

SPECIAL TOOL CARD

| TOOL NO. | TYPE OF TOOL | SIZE OF TOOL | MACHINE USED ON |
|---|---|---|---|
| T-1979 | Reamer | .6245 Diam | 7/8" Cone Auto. Screw Machine |
| T-1980 | Drill Jig | Two Holes 5/32 diam. | #1 Avey Drill Press |
| T-1981 | Perforating Die | Three Holes .197 dia. | #18 Bliss Press. |
| T-1982 | Milling Fixture | 1/2" Slot | 18" Cincinatti Milling Machine |
| T-1983 | Compound Die | 3/4 OD x 1/2 ID Washer | #18 Bliss. Press. |
| T-1984 | Drill Jig. | Four holes 3/4 dia. | #2 Avey Drill with 4 Spdl. Head |
| T-1985 | Reaming Fixture | One hole .625 dia. | 14" Leland Gifford P.F. Drill |
| T-1986 | Riveting Die | Two 7/16 Rivets | #1 Taylor & Fenn Spring Press |
| T-1987 | Circ. Form Tool | — | #00 B. & S. H.S. Auto. Screw Mach. |
| T-1988 | Circ. Cut off Tool | 1/16 wide | " " " " " " |
| T-1989 | Step Counterbore | .692 & .786 dia's. | Jones & Lamson Turret Lathe |
| T-1990 | Flat Form Tool | — | " " " " |
| T-1991 | Flush Pin Gage | 1.967 Depth | Bench |
| T-1992 | Length Gage | 3.964 Length | Bench |
| T-1993 | Beading Rolls | Two- 1/8" Beads | Bliss Bead Rolling Machine |
| | | | |

The processing department needs to know the relative cost of different ways of doing an operation in order to know which method to use, and goes to the standards department to get this information. The standards department, on the other hand, wishes to know which of two contemplated methods best suits the machine tool requirements, or questions the material advantage to be gained by a certain tool change and so it comes to the processing department.

Possibly the cost department needs information as to how an article it is figuring on would be lined up for production. It comes to the processing department for this information.

Under the processing engineer comes also the methods investigation. This is done by a man or group of men, as the case may be, whose duties are mainly the investigation of new methods and ways of performing operations. This is an interesting and highly specialized work requiring men with long and varied shop careers together with all of the technical knowledge it is possible for them to get. The job involves familiarity with the standards or piece-work system in use in the factory and a thorough understanding of cutting materials, materials to be cut, proper cutting speeds and feeds, and a comprehensive knowledge of machine tools, special machine and tool design.

Their duties consist principally of studying jobs or operations which have been reported as being high in cost, producing excess scrap, or for some reason not being up to standard, devising some means of overcoming the trouble and seeing that the remedy is applied.

They also investigate requests from the factory for changes in operations, and actually follow through sufficient quantities of work in each case to prove that the new methods are warranted.

The problem of providing for short orders, or to be more exact, orders which come through the factory in small quantities is serious to the processing engineer. It is not practical to make up new tooling for the majority of this kind of work. It must be done with tooling which is available. This is where a good set of tooling records in the processing and tool engineering departments becomes an asset. The tools available for substitution on this character of work may be quickly identified.

It is often necessary to make new tooling for these short order jobs when no adequate tooling is at hand. These new tools will naturally be of simple design and cheap construction. They are not usable for large production, and should bear a symbol which will designate them both on the records and on the tools themselves as such. This classification on the records will at once call attention to the fact that this tooling is not suitable for high production.

These methods-investigation men referred to previously are, or should be, available for work of this character also. Looking up and providing "pick up" tooling for this class of work and cataloging it on operation sheets. A glance at an operation sheet bearing the symbols adopted for distinguishing tools made for short order jobs will call attention to the fact that it is a short order job and, should the production on one of these jobs be increased, the fact that the tooling should be redesigned will be evident.

Taken as a whole, the processing engineer is generally a very busy man. If he is to be successful he must keep constantly in touch with the way work is being done in the shop as well as know how it is supposed to be done. He must also answer questions regarding work in process

in the shop, questions of whether he shall give this or that department an additional operation to finish the part in question or shall hold them to the operation sheet? These and many other questions come before him every day, and his decisions must be prompt and accurate.

The position of tool engineer is the next one we will consider. A careful analysis of the qualifications necessary to the successful conduct of this office will show a demand for a technical education of a high order, together with a varied and practical experience in manufacturing methods, machine tools, tool and die making methods, tool steels and the hardening and tempering methods.

His work shares importance with that of the processing engineer, both jobs being what might be called pioneer work; that is, there is no precedent for most of it.

The tool engineer with an experience as outlined above has a great store of knowledge to draw upon for designs of new tools, dies, jigs, fixtures, etc., but the wise tool engineer will not depend entirely upon this source. He will also avail himself of the ideas which the foremen, set-up men, operators or inspectors may have regarding the many points of tool design, easier methods of operating, more convenient movements and easier loading facilities. All of these and more may be obtained from these men, if the proper approach is made.

The present-day demand for high production and low cost is naturally creating a demand for a constantly higher grade of tools, tools which will produce more work and better work. This is the demand made upon the tool engineer today.

A large percentage of the reason why a job runs successfully in the shop, or does not, may be traced to the design of the tooling.

It is quite often easy to see how a tool or set of tools might be improved upon after they are made up and installed on the machines, but the point to consider is the fact that the tool engineer, when he designs these tools, does not have any precedent to go by but must take his ideas out of thin air and have an imagination vivid enough to be able to construct the set of tools in this manner, rarely having the chance to improve them.

The keeping of accurate and dependable records in the tool engineering department is of great assistance when the designing of new tools is contemplated. The proper maintaining of such a filing system is a big job, but the work cannot be carried on intelligently without it.

The first consideration is the method to be used for numbering the tool drawings, there being many good ways of doing this, none of which will be recommended here as all have their goods points to suit the conditions under which they are used.

The work part the tool is to be used on may be used with a prefix or suffix in symbol which identifies the tool, such as —1706–R.M. 15, which describes this tool as being a machine reamer used on part number 1706, the 15 being a symbol previously determined to denote the size of reamer.

Another system involves the use of a special tool number preceded or followed by a letter, such as—T–10726 —the letter simply being a symbol used to designate the number as being a tool number. Under this system, the tool number is conected with the work part through the medium of the operation sheet, is filed in the tool vault under the tool number only, and is checked out by the tool number.

The most important file in the tool engineering department is the file maintained under this tool number. It may be a card file or a set of books as desired, listing each tool under its number and describing it fully, as shown in Fig. 5.

Next comes the file listing everything under the part or piece number, on this card may be found all of the special tools which have been made up for the particular part number. This is shown in Fig. 6.

The third file groups the tool, such as, circular form tools, jigs, fixtures, the several kinds of dies, etc., as shown in Fig. 7.

This file is used a great deal by the processing engineer and his men and also by the tool engineer for comparison with new designs contem-

PART NAME Pivot Bolt NO. 15296

| TOOL NO. | TOOL NAME | MACHINE USED ON |
|---|---|---|
| T-2019 | Header Dies - 7/8 Hex | Ajax Header 3-3/4" |
| T-1976 | Block and Rest - Thd. 7/8 x 8 | Acme Bolt Threader - 5/8" |
| T-2119 | Drill Jig - Drill 1/8 hole | 12" Leland Gifford Drill Press |

NAME OF TOOL Washer Dies

| TOOL NO. | TYPE OF TOOL | SIZE OF TOOL | MACHINE USED ON |
|---|---|---|---|
| T-1983 | Multi. Comp. Die | 3/4 O.D. x 1/2 I.D. | #18 Bliss Press |
| T-2018 | Sing. Comp. Die | 1 1/4 O.D. x 7/8 I.D. | #20 Bliss Press |
| T-3112 | Multi. Comp. Die | 7/8 O.D. x 7/16 I.D. | #1 1/2 K. & O. Press |
| T-3668 | " " " | 1 1/16 O.D. x 15/32 I.D. | #1 1/2 K. & O. Press |
| T-3690 | " " " | 540 O.D. x 1/4 I.D. | #20 Bliss Press |
| T-3710 | " " " | 11/32 O.D. x 3/16 I.D. | #20 Bliss Press |
| T-3840 | Sing. Comp. Die | 1 1/2 O.D. x 15/16 I.D. | #18 Bliss Press |
| T-3911 | " " " | 1" O.D. x .760 I.D. | #18 Bliss Press |

Above—Fig. 6

Below—Fig. 7

plated, likewise in the search for tools which may be altered for use on new parts.

In a tool engineering department where there is a variety of work, such as automatic screw machine tools, jigs and fixtures, dies, gages, etc., it is advisable to divide the designers into groups, segregating them with a group leader for each section. This leader may act as checker, unless the group is too large. One checker cannot care for more than four designers, as a usual thing.

The tool engineer has received the preliminary operation sheets and tool design order slips from the processing engineer, as described in the preceding chapter, and after a careful survey of the work and a rough planning of the outlines to be followed, is ready to turn these orders over to the group leaders, together with his instructions.

The second in a series of articles. The first appeared last week.

■

## Skill and First Principles—*Discussion*

W. R. NEEDHAM
*Engineer Design Department, English Electric Co., Ltd.*

CHARLES Schoen's address, referred to on page 213, Vol. 74, of the *American Machinist*, contains some sound and sane advice, not only for mechanics, but for all engineers, whether their job is in shop or office. Rule of thumb can be a very sorry jade and lead even the most sensible practical man astray. There can be no doubt that firm grounding in principles can and does help as nothing else will. A man in the shop is apt to be classed as "practical" simply because he wears overalls or wields a spanner, while his colleague in the design or drawing office is by the same token styled a "paper man." Yet either can be equally non-practical or practical.

The late Dr. Daniel Adamson, of the company bearing his name, included design and drawing office experience in the category "practical." In the best sense he was right. The draftsman who relies blindly upon formula without knowing or appreciating the significance or understanding the basic principles, must be classed with the workman who, given the task of smashing dud castings, attacks them at their strongest parts.

The crasser errors of judgment can be and will be obviated by a modest grounding in the principles of mechanics. The mental concentration for this elementary training is certainly not beyond the grasp of the majority of intelligent elder operatives. Fortunately, it is part and parcel of the average trade apprentice's training that he shall undertake courses in workshop mathematics and mechanics. I knew years ago a self-taught man who used an unusual means of proving the right-triangle theorem that the square on the hypotenuse equals the sum of the squares on the other two sides. When he gave the ordinary proof to a class of boys, one of the lads failed to understand it. The instructor, therefore, drew an ordinary 3-4-5 right triangle upon the board and had the pupil draw the squares of the sides, subdivide them, and count the squares to be convinced.

It is surprising how, when one gets to know why and wherefore, the interest in what one does grows apace. Not only skill and facility benefit, but their scope is greatly enlarged. It helps ordinary men to grow into the bigger job for which they are thus qualifying themselves.

## A Corrosion-Preventive Cutting Compound for General Shop Use

THOMAS E. DUNN
*Works Manager, The Bullard Co.*

FOR a number of years we had trouble in the use of cutting compound on our milling machines, grinders, lathes and vertical turret lathes. Ordinarily, the better type of prepared paste or powder was purchased, but, notwithstanding, the cutting compound changed chemically after short runs, and corroded both the machine tables and work. Furthermore, the compound developed a very offensive odor and a "slimy" appearance. These conditions also arose when soluble oil was mixed with water and alkali.

For these reasons, an investigation of the underlying causes for the chemical break-down of cutting solutions was undertaken. The odor of the unsatisfactory compound led us to believe that the tap water contained bacteria and organic matter which shortly caused a chemical change. Our first step was unsuccessful; that is, addition of alkali, which saponified the mixture to some extent, but which did not have a permanent effect.

Finally, to kill bacteria and remove organic matter, we evolved the following procedure. Water, boiled and allowed to cool to room temperature, is then softened with a weak alkali such as borax. The borax saponifies the soluble oil which should be added next. Finally, a small quantity of tri-sodium phosphate is added to emulsify the solution. A recipe for 50 gal. of this solution is as follows:

47 gal. boiled water (cooled to room temperature)
3 lb. borax
3 gal. soluble oil
1 lb. tri-sodium phosphate

The solution should be made up in the order of listing the ingredients.

From the experience of using this cutting compound for a period of six months, we deduce the following:

1. Milling cutters, reamers, drills, cutting tools and grinding wheels have 30 per cent longer life because of the superior lubricating and heat-absorbing qualities of the compound.
2. Machined parts are left with a thin film of oil that prevents rusting for a considerable period of time.
3. Tables, ways, and other parts of machines, as well as the cutters and tools, are left with a thin film of oil that prevents rusting.
4. Savings made in the amount of soluble oil used approximate one-third, since we have determined the exact quantity of oil to be used in this universally applicable compound.
5. No tendency to develop odors or "slime" has been discovered in the compound used for a period of four months.
6. When this solution is employed on grinders, the the wheel cuts freely and the work does not tarnish or rust. For example, work that was inspected one week after being ground, but which had not been wiped or dried in any way, was found to be free of any evidence of corrosion. This was found to apply to cast iron as well as to steel.

After six months' experience with this cutting compound, we believe it can be used as a universal lubricant throughout the plant. We have standardized on it.

# IDEAS FROM PRACTICAL MEN

## Machining a Hemispherical Bronze Casting

O. S. MARSHALL

IN THE illustration are shown two views of a hemispherical bronze casting, 30 in. in diameter and having nineteen holes to be machined in accurate positions. Since the weight of the casting is but 140 lb., its comparative lightness, together with the extreme accuracy with which it must be machined, makes the work rather difficult.

In the first operation, the casting was mounted on the faceplate in a lathe, and the central hole, or polar axis, was machined, as was also the annular surface surrounding the hole. These finished surfaces provided means of supporting the casting against the faceplate when machining the large diameter, or equatorial ring, this operation being shown in Fig. 1. It will be noted that a six-armed spider is employed for supporting the ring, the spider taking its support from a mandrel held between the lathe centers.

After the completion of these two operations, the casting was placed in a horizontal boring mill, being mounted on a home-made fixture that is a combination of an adjustable angle plate and a graduated circular table, as shown in Fig. 2. The angle plate has a range of adjustment from the horizontal to the vertical, providing a means of setting the casting so that the holes can be machined at the correct spherical angles, simply by exercising care in the angular setting of the angle plate and in indexing the work. Several pegs driven into the circular table were machined to act as a pilot for the inner diameter of the equatorial ring, thereby centering the casting. Sufficient clamps were used to insure the positive holding of the casting against the table during machining operations.

After all the holes were roughed out, the casting was

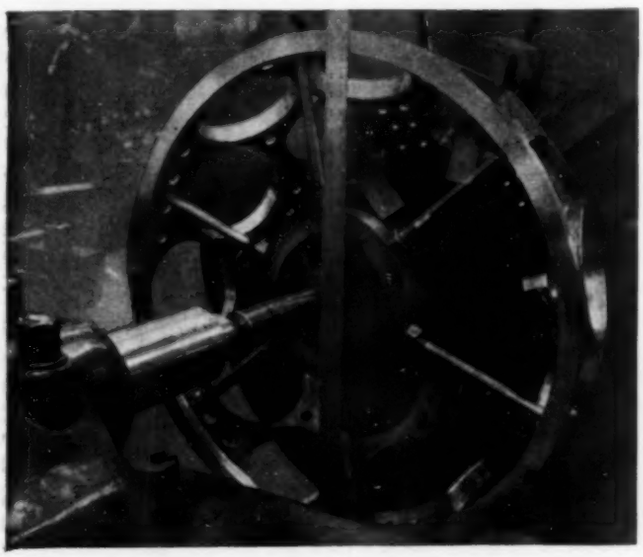


Fig. 1

Fig. 2

returned to the lathe and corrections were made on the two flat surfaces to overcome any distortion that may have taken place because of stock removal or from other causes. It was then put back on the boring mill for finishing the holes. With the casting set central crosswise, there remained the necessity for setting the boring head to the correct height in accordance with the angular setting of the angle plate. This setting was made by using a test bar in the spindle. A center line on the test bar was made to coincide line on a plug set in the axis of the circular table.

The casting, which is part of a solar furnace, is to carry nineteen lenses, each 7½ in. in diameter. Each lens has a common focal point where the axis of the casting passes through the equatorial plane.

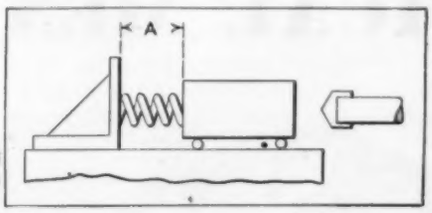
## Determining Spindle Thrusts

O. W. SCHRICKER

It became necessary to replace the thrust bearing for the spindle of a large horizontal boring mill. After repairs had been made, the bearing again failed in a short time. To avoid the same mistake, it was decided to determine just how much thrust was on this bearing. The machine was mainly used for drilling holes from 2 to 5 in. in diameter and from 24 to 60 in. deep in S.A.E.–1035 forgings.

A short billet of this material was mounted on rollers on the table. Suitable means were provided at the top and the sides to keep the billet from turning and yet keep the rolling friction at the minimum. An angle plate was fastened at the rear of the billet, away from the cutting tool, and a heavy spring was introduced between the front of the angle plate and the rear of the billet. The sketch shows the arrangement diagrammatically.

Selecting one of the largest drills and using the same speeds and feeds as in regular operation, several preliminary cuts were made, being satisfied that everything was all right, the machine was then operated under running conditions and the deflection of the spring was measured at *A*. Several readings were taken to insure




accuracy. The spring was then put into a testing machine and compressed the same amount as noted when the drilling was being done. The force required to compress the spring the amount before determined, gave the pounds of thrust on the bearing in drilling. The result easily showed why the bearing had failed.

As a matter of information, readers may be interested in knowing that the thrust recorded showed that in drilling a 5½-in. hole, with the drill running at 50 r.p.m. and with a feed of 0.010 in. per revolution, averaged 6,725 pounds.

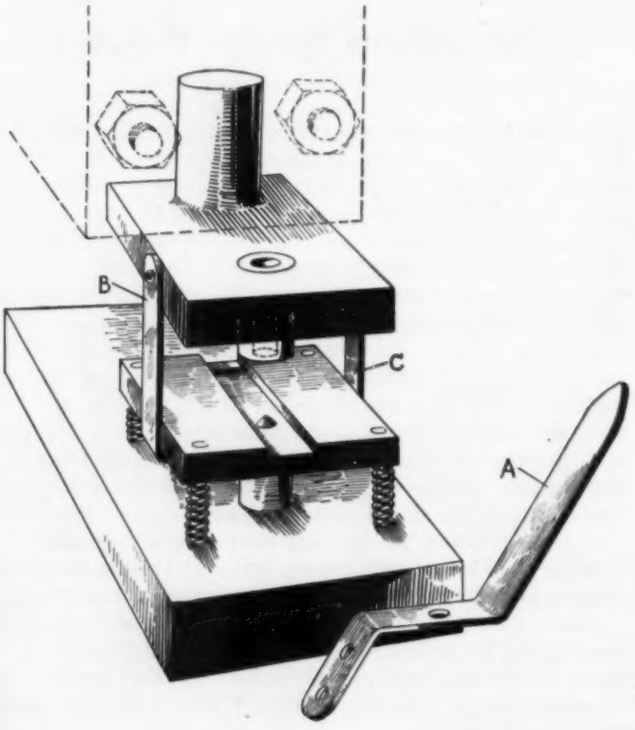
■

## An Inverted Punch and Die

CHARLES H. WILLEY
*Superintendent of Manufacturing*
*Hoyt Electrical Instrument Works*

It was recently necessary to make a change in the design of a part used in one of our most popular types of instruments. While we had on hand many thousands of the finished parts, one of which is shown in the illustration, fortunately the change simply involved the addition of a hole at *A* to accommodate a binding post. The part is of ⅛ in. cold-rolled steel, and the hole is ⅛ in. in diameter.

Since punching was considered the cheapest way to make the hole, the tools illustrated were made. The part did not lend itself to an easy job of punching, due to the length of the legs on each side of the flat where the hole was to be. To provide room for one of the legs, the tools were offset. They were also inverted, the die being held in the punch-holder and the punch in what would ordinarily be the die-shoe. The part is laid in a channel in the stripper, being located lengthwise by having one of its legs passed through a slot in the rear. Springs hold up the stripper until the die strikes the work, at which time it descends in unison with the ram. It is brought to its original position by the links *B* and *C* as the ram ascends, thus stripping the work from the punch. I would like to know how others would handle this job.

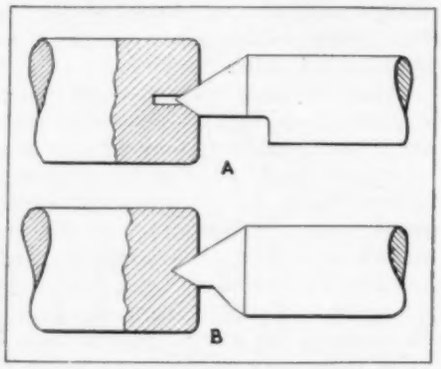



■

## A Three-Quarter Center for the Tailstock—*Discussion*

D. Q. DUNSTONE
*Hetton-le-Hole, County Durham, England*

In an article under the title given above, on page 217, Vol. 74, of the *American Machinist,* Henry W. Boehly suggests an improvement on the center described by J. W. Towlson on page 446, Vol. 73. The design of the center described by Mr. Boehly invites criticism, since a considerable amount of stock is removed from the part of the center that already offers the least resistance to the stress acting upon it. As a result, the operator is able to traverse his tool past the work when facing the end. If this may be termed an advantage, does it justify the removal of so much material from the center?




The reduction that can be effected in the diameter of the work is no greater than in the case of the center indicated at *A*. Examining the center described by Mr. Boehly, one wonders just what kind of a cutting tool is expected to occupy so great a clearance. I suggest that the clearance in the center shown at *B* will admit any tool that could be advantageously applied to this part of the of the work. It therefore becomes apparent that very little material need be removed from a center to obtain the maximum advantage, provided the operator uses his tools intelligently.

■

## Boring With a Single-Point Cutter

DANIEL I. KRAUSS

In overhauling a surface grinder, we decided to replace the worn bronze bushings for the spindle bearings with tapered roller bearings having suitable means for taking up end motion. The job required the use of a boring machine of some sort, which we did not have, so we did the work in a milling machine. Not having a boring bar

with micro adjustment, we were forced to do the work with a single-point cutter held in the boring bar by a setscrew. The cutter was set approximately and a roughing cut was taken, the hole being calipered and the size found by setting a micrometer to the calipers. One-half the difference between the diameter of the hole just bored and that of the finished hole is the amount the cutter must be finally set out.

The cutter was withdrawn from the work and a dial indicator was attached to a convenient part of the work. The indicator spindle was brought into contact with the point of the cutter and the dial of the indicator was set to read zero. Slightly loosening the setscrew, the cutter was carefully tapped out until the indicator showed the required advancement. After tightening the setscrew, the reading was again taken to make sure that in tightening the screw the setting of the cutter had not been disturbed. As many cuts were taken as were necessary to bring the holes to within 0.005 in. of the diameter of the bearing races, which were then pressed in.

By this method of setting the cutter, it is not required that the bar shall either run true or be of the same diameter at all parts; neither does it involve the use of any tools that are not available in almost any shop. If a very accurate job is required, care should be taken to see that the cutter and the indicator spindle are axially in line when taking the readings, otherwise the indicator will give a false reading.

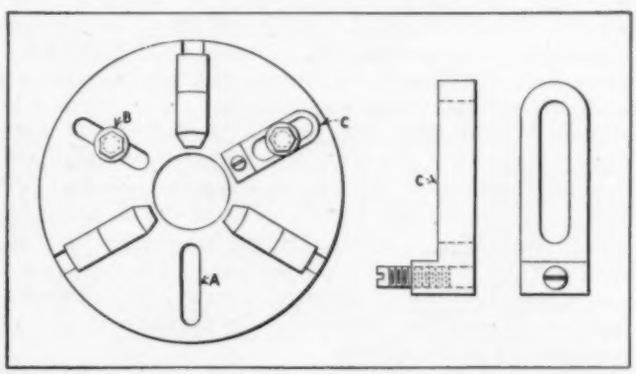
■

## Holding Thin Work in the Lathe Chuck
### *Discussion*

CHARLES KUGLER

Referring to the articles under the title given above, by Richard H. Kiddle and H. J. Gustav Kopsch (*A.M.*—Vol. 74, pages 183 and 624, respectively), neither of the authors seem to have taken into consideration the fact that the bodies of chucks seldom, if ever, run true. If they do, then the jaws are likely to run out. Under such conditions, no matter what type of non-adjustable spacing blocks are used, the finished work will not be parallel.

If the face of the chuck is provided with slots, as at *A* in the illustration, bolts can be placed in them, as at *B*. A light cut taken over the ends will bring work, seated against them, parallel. If there are no slots in the face of the chuck, holes can be drilled and tapped for attaching spacers having adjusting screws, such as the one indicated at *C*. The screws can be adjusted so that they will be in the same plane by screwing them in or out until they contact with a tool held in the toolpost. Or a light cut can be taken over them. Parallel work can be produced by the use of either of the spacers described, regardless of either the chuck or its jaws. I use such devices on the vertical boring mill when no parallels are available.

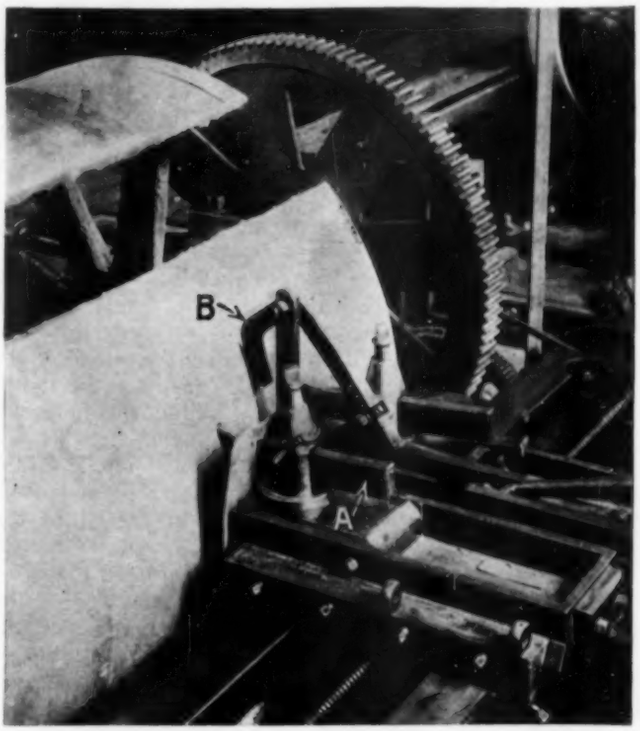



■

## Turning a Drum of Two Diameters

AVERY E. GRANVILLE

One of the most peculiar jobs that I ever ran across was the turning of a drum having segments of two diameters, as shown in the illustration, the difference in diameter being about one inch. Between the segments there are gaps, diametrically opposite one another,




though but one of gaps can be seen in the illustration. Advantage is taken of the gaps to turn both segments in one operation in a special lathe.

The drum is mounted in pillow blocks on its own shaft, to one end of which a driving gear is keyed. This gear is driven through a train of gears from the pulley below. The really ingenious part of the mechanism, however, is the method of bringing into operation the tool for turning the smaller segment. A tool set for turning the larger segment will, of course, clear the smaller one and remains in a fixed position.

The tool *A* for turning the smaller segment is carried in a toolpost mounted in a clapper. In the position shown in the illustration, this tool is cutting, while the point of the other tool is half an inch from the surface. As the drum revolves, the advancing edge of the larger segment strikes the lever *B* and causes it to pull up the clapper to which its outer end is connected by a rod. Thus the tool is lifted clear of the larger segment and

is kept clear of it while the other tool is turning, and is kept clear of it until the next gap permits it to drop back into cutting position.

The drums are required in large quantities and several of the special lathes are employed in turning them. One operator can attend to several lathes, making the production cost comparatively low.

■

## Rigid Feed-Attachment for the Drill Press
### *Discussion*

T. E. JARNIGAN

In reading G. R. Richards' article (*AM*—page 552, Vol. 74), I was reminded of an unusual problem in sensitive drilling that confronted us as the result of a mistake by the engineering department. The parts were clevis pins 1 in. in diameter, headed at one end and having a $\frac{3}{16}$-in. hole drilled near the other end for a cotter pin. In ordering, the distance from under the head to the center of the hole for the cotter pin, as given, was $\frac{3}{32}$ in. too great, consequently the holes for the cotter pins were too far from the heads. The result was that the inspector would not accept the pins in assembly. Since some 14,000 pins were involved, scrapping them was out of the question.

To remedy the defect, it was determined to drill $\frac{3}{16}$-in. holes the correct distance from the heads, at right angles to the holes already drilled. Since ours was a small shop, an ordinary sensitive drill was the only available machine for the work. Attempts to drill the pins brought disaster, because the drill would run into the holes already drilled, jam, and break. Filling the holes by welding was too expensive to contemplate, so we attempted to plug them with pieces of iron rod, sawed to length, driven in with a hammer and peened over. While this method was satisfactory in regard to the drilling, the cost was too great.

The method finally adopted was to drive the end of a $\frac{3}{16}$-in. rod into the hole and to enter the end of the pin into a 1-in. cast-off die. A sharp blow from a hammer on the head of the pin sheared the rod and also created enough burr on each side to hold the filler pin in place during the drilling, after which its staying in place was unimportant. The die used was the usual circular type, held in an old dieholder clamped to a discarded surface plate. The die was easily removable to permit knocking out the clevis pins, which of course could not pass through because of their heads.

In drilling the pins, we found that inexperienced operators invariably jammed the drill and broke it. An experienced operator, however, had no difficulty whatever in doing the job on a piece work basis. His hand was sensitive enough to feel the effect on the drill when it encountered the filler rod in the old hole, and also to feel the diminished downward resistance of the drill as the point came through the pins. It was, of course, necessary to take up all end play in the spindle in order to give the operator absolute control over the drill.

I have often thought since that we might better have used a hardened pin attached to a jig and suitably formed to guide the drill, thus eliminating the operation of driving in pins. The hardened pin could project from one side of a split V-block which would provide adequate support.

# SEEN AND HEARD

●

### Less Foot-Work, More Production

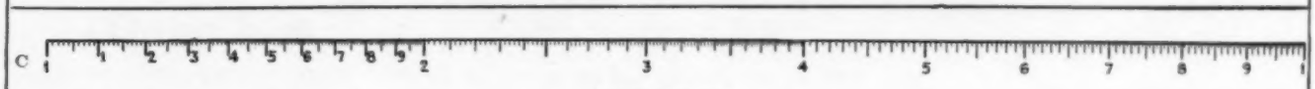
A PROMINENT maker of electrical instruments who operates his own plastic molding department reports saving as much as eighteen per cent in production time by the use of duplex presses in favor of two separate or individual presses. The duplex press has two rams side by side in a common base, with only a few inches between. Time saving results from the saving in steps which the operator need take. He tends both presses without moving more than one step from one to the other. Experiments in conserving heat in the upper or hot side of these presses by closing them in with heat insulating walls, are now in progress. The doors to chambers formed by these walls, are lifted vertically by small hydraulic cylinders, the valves for which are so arranged that the door does not close until the mold is fully closed, and opens instantly when the mold is to be removed from the press.

### In the Stilly Night—

IT SEEMS that the vertical air receiver for a large compressor required another outlet. The factory inspector, called in to give his decision, stated flatly that the new outlet must be forged and its flange riveted to the tank, else he would not pass it. Welding might be used only for caulking, he decided. Arguments were unavailing, and it looked like a big job, for the tank had the usual upper head riveted from within and lower head riveted from without, with no manhole provided. The tank was used every day, and the time required to disconnect it, turn it over, remove the head, insert the outlet, and rerivet the head could not be found. The company welder, strolling by, invited himself to the meeting, and drawing the manager aside, offered a solution. He said simply that if the outlet were made for him, he would have the tank ready overnight—with the flange riveted in place as required.

His offer was accepted, and the flange was discovered soundly riveted in place one bright morning. The inspector, noticing that the rivets in the bottom head had not been disturbed, grew suspicions, and put on pressure. The working limit was passed with no leak, then the safe limit, and finally the seams began to leak—making still more work for the welder. But the outlet held leakless. The inspector finally gave up and O.K.'d the set-up. When cornered by the manager, the welder's explanation was simple. He had tack-welded the flange to the tank, then cut the outlet hole through the tank wall with an acetylene torch and drilled the riveted holes through. In cutting the outlet hole, he allowed a shoulder large enough for a good heavy inside fillet capable of standing well over the required strain, and had also welded all 'round the outside edge of the flange. The rivets were then inserted through the outlet hole and held in from the inside while the outer ends were heated and a bead built up to stimulate a rivet head. This was then set to rivet-head shape with an air hammer and die, and the job was complete.

# Interconversion Tables and Chart




MULTIPLY BY

| TO CONVERT FROM | To Cu. In. | To Cu. Ft. | To Cu. Yd. | To Fl. Oz. | To Pint | To Quart | To Gallon | To Grain | To Oz. Troy | To Oz. Av. | Lb. Troy | To Lb. Av. | To CC, of G. | To Ltr.orKg | To Cu. M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cu. in. | 1.00000 | $.0_3$5787 | $.0_4$2143 | .554112 | .034632 | .017316 | .004329 | 252.891 | .526857 | .578037 | .043905 | .036127 | 16.3871 | .016387 | $.0_4$1639 |
| Cu. Ft. | 1728.00 | 1.00000 | .037037 | 957.505 | 59.8442 | 29.9221 | 7.48052 | 436996 | 910.408 | 998.848 | 75.8674 | 62.4280 | 28316.9 | 28.3169 | .028317 |
| Cu. Yd. | 46656.0 | 27.0000 | 1.00000 | 25852.6 | 1615.79 | 807.896 | 201.974 | $117990_3$ | .24581.0 | 26968.9 | 2048.42 | 1685.56 | 764556 | 764.556 | .764556 |
| Fl. Oz. | 1.80469 | .001044 | $.0_4$3868 | 1.00000 | .062500 | .031250 | .007813 | 456.390 | .950813 | 1.04318 | .079234 | .065199 | 29.5736 | .029573 | $.0_4$2957 |
| Pint | 28.8750 | .016710 | $.0_3$6189 | 16.0000 | 1.00000 | .500000 | .125000 | 7302.23 | 15.2130 | 16.6908 | 1.26775 | 1.04318 | 473.177 | .473177 | $.0_4$4732 |
| Quart | 57.7500 | .033420 | .001238 | 32.0000 | 2.00000 | 1.00000 | .250000 | 1460.45 | 30.4260 | 33.3816 | 2.53550 | 2.08635 | 946.354 | .946354 | $.0_3$9463 |
| Gallon | 231.000 | .133681 | .004951 | 128.000 | 8.00000 | 4.00000 | 1.00000 | 58417.9 | 121.704 | 133.527 | 10.1420 | 8.34541 | 3785.42 | 3.78542 | .003785 |
| Grain | .003954 | $.0_3$2288 | $.0_3$8475 | .002191 | $.0_3$1369 | $.0_4$6850 | $.0_4$1712 | 1.00000 | .002083 | .002286 | $.0_3$1736 | $.0_3$1428 | .064799 | $0_4$6479 | $.0_7$6479 |
| Oz. Troy | 1.89805 | .001098 | $.0_4$4068 | 1.05173 | .065733 | .032867 | .008217 | 480.000 | 1.00000 | 1.09714 | .083333 | .068571 | 31.1035 | .031104 | $.0_4$3110 |
| Oz. Av. | 1.72999 | .001001 | $.0_4$3708 | .958608 | .059913 | .029957 | .007489 | 437.500 | .911457 | 1.00000 | .075955 | .062500 | 28.3495 | .028350 | $.0_4$2835 |
| Lb. Troy | 22.7766 | .013181 | $.0_3$4882 | 12.6208 | .788800 | .394400 | .098600 | 5760.00 | 12.0000 | 13.1657 | 1.00000 | .822857 | 373.242 | .373242 | $.0_3$3732 |
| Lb. Av. | 27.6799 | .016018 | $.0_3$5933 | 15.3378 | .958611 | .479306 | .119826 | 7000.00 | 14.5833 | 16.0000 | 1.21528 | 1.00000 | 453.593 | .453593 | $.0_3$4536 |
| CC or Gram | .061024 | $.0_4$3531 | $.0_5$1308 | .033814 | .002113 | .001057 | $.0_3$2642 | 15.4323 | .032151 | .035274 | .002679 | .002205 | 1.00000 | .001000 | .000001 |
| Liter or Keg | 61.0237 | .035315 | .001308 | 33.8140 | 2.11337 | 1.05669 | .264172 | 15432.3 | 32.1507 | 35.2739 | 2.67923 | 2.20462 | 1000.00 | 1.00000 | .001000 |
| Cu. M. | 61023.7 | 35.3146 | 1.30795 | 33814.0 | 2113.37 | 1056.69 | 264.172 | $154320_3$ | 32150.7 | 35273.9 | 2679.23 | 2204.62 | 1000000 | 1000.00 | 1.00000 |

Note. The small subnumeral following a zero indicates that the zero is to be taken that number of times; thus, $.0_3$1428 is equivalent to .0001428.

Values used in constructing table:
1 inch = 2.540001 cm.
1 cu. in. = 16,387083 cc. = 16.387083 g $H_2O$ at 4°C. = 39°F.
1 lb. av. = 453.5926 g.
∴1 gal. = 8.34541 lb.
∴1 lb. av. = 27.679886 cu. in. $H_2O$ at 4°C.
1lb. av. = 7000 grains.
∴1 gallon = 58417.87 grains.
231 cu. in. = 1 gallon = 3785.4162 g.

MULTIPLY BY

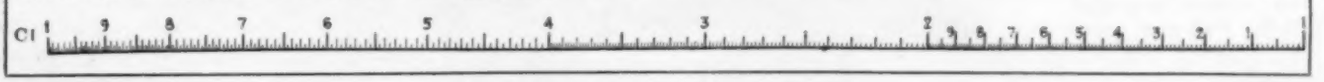
| TO CONVERT FROM | B.T.U. | P.C.U. | Cal. | Ft. Lbs. | Ft, Tons | Kg. M. | HP Hrs. | KW Hrs. | Joules | Lbs. C | Lbs. $H_2O$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| B.T.U. | 1.00000 | .555556 | .251996 | 778.000 | .389001 | 107.563 | $.0_3$3929 | $.0_3$2931 | 1055.20 | $.0_4$6876 | .001031 |
| P.C.U. | 1.80000 | 1.00000 | 45.3593 | 1400.40 | .700202 | 193.613 | $.0_3$7072 | $.0_3$5276 | 1899.36 | $.0_3$1238 | .001855 |
| Calories | 3.96832 | 2.20462 | 1.00000 | 3091.36 | 1.54368 | 426.844 | .001559 | .001163 | 4187.37 | $.0_3$2729 | .004089 |
| Ft. Lbs. | .001285 | $.0_3$7141 | $.0_3$3239 | 1.00000 | .000500 | .138255 | $.0_5$5050 | $.0_5$3767 | 1.35625 | $.0_4$8840 | $.0_5$1325 |
| Ft. Tons | 2.57069 | 1.42816 | .647804 | 2000.00 | 1.00000 | 276.511 | .001010 | $.0_3$7535 | 2712.59 | $.0_3$1768 | .002649 |
| Kg. M. | .009297 | .005165 | .002343 | 7.23301 | .003617 | 1.00000 | $.0_3$3653 | $.0_3$2725 | 9.81009 | $.0_4$6394 | $.0_3$9580 |
| HP Hrs. | 2544.99 | .141388 | 641.327 | 1980000 | 990.004 | 273747 | 1.00000 | .746000 | 2685473 | .175044 | 2.62261 |
| KW Hrs. | 3411.57 | 1895.32 | 859.702 | 2654200 | 1327.10 | 366959 | 1.34041 | 1.00000 | 3599889 | .234648 | 3.51562 |
| Joules | $.0_3$9477 | $.0_3$5265 | $.0_3$2388 | .737311 | $.0_3$3687 | .101937 | $.0_5$3724 | $.0_5$2778 | 1.00000 | $.0_4$6518 | $.0_5$9766 |
| Lbs. C. | 14544.0 | 8080.00 | 3665.03 | $113150_3$ | 5657.63 | 1564396 | 5.71434 | 4.26285 | $153470_3$ | 1.00000 | 14.9876 |
| Lbs. $H_2O$ | 970.400 | 539.111 | 244.537 | 754971 | 377.487 | 104379 | .381270 | .284424 | 1023966 | .066744 | 1.00000 |

"P.C.U." refers to the "pound-centigrade unit." The ton used is 2000 pounds. "Lbs. C" refers to pounds of carbon oxidized, 100% efficiency equivalent to the corresponding number of heat units. "Lbs. $H_2O$" refers to pounds of water evaporated at 100°C. = 212°F. at 100% efficiency.

By the use of the foregoing table[1] about 330 interconversions among twenty-six of the standard engineering units of measure can be directly estimated from the alignment chart to three significant figures or calculated by simple multiplication to six figures. The multiplier factor given in the table is located on the center scale "A" giving the point which when aligned with any number point on "C1" determines the product on "C." Imperfections in the scale due to lack of precision in printing should be checked at intervals along "A" scale by actual division of "C" by "C1," the lines being left out so that the reader can do this. A line scratched on a transparent celluloid triangle gives the best medium for making alignments.

When volume and weight interconversions are given, water is the medium the calculations are based upon. By the introduction of specific gravity factors the medium can be changed, giving the weight of any volume of any material, etc.

[1]Compiled by and published by the courtesy of the engineering department, E. I. du Pont de Nemours & Company, Inc.





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# • • • • SHOP EQUIPMENT NEWS

## "G&L" No. 30 Two-Spindle, Horizontal Boring, Drilling and Milling Machines

CONSTRUCTIONAL features of the No. 70 machine announced last week have been largely carried over into the design of the smaller No. 30 machine now announced by the Giddings & Lewis Machine Tool Company, Fond du Lac, Wis. Whereas the No. 70 has a 7-in. main spindle, the No. 30 employs a 3-in. main spindle, and is proportionally smaller. It likewise makes use of a high-speed auxiliary spindle, which is 2 in. in diameter. Speeds for the main spindle range from 8.3 to 500 r.p.m. in 36 geometrical steps, and for the high-speed spindle from 25 to 1,500 r.p.m. in 36 steps. Thus, the No. 30 has a higher range of spindle speeds than the No. 70. Herringbone gears and preloaded combination radial and thrust ball bearings assure smooth-running spindles.

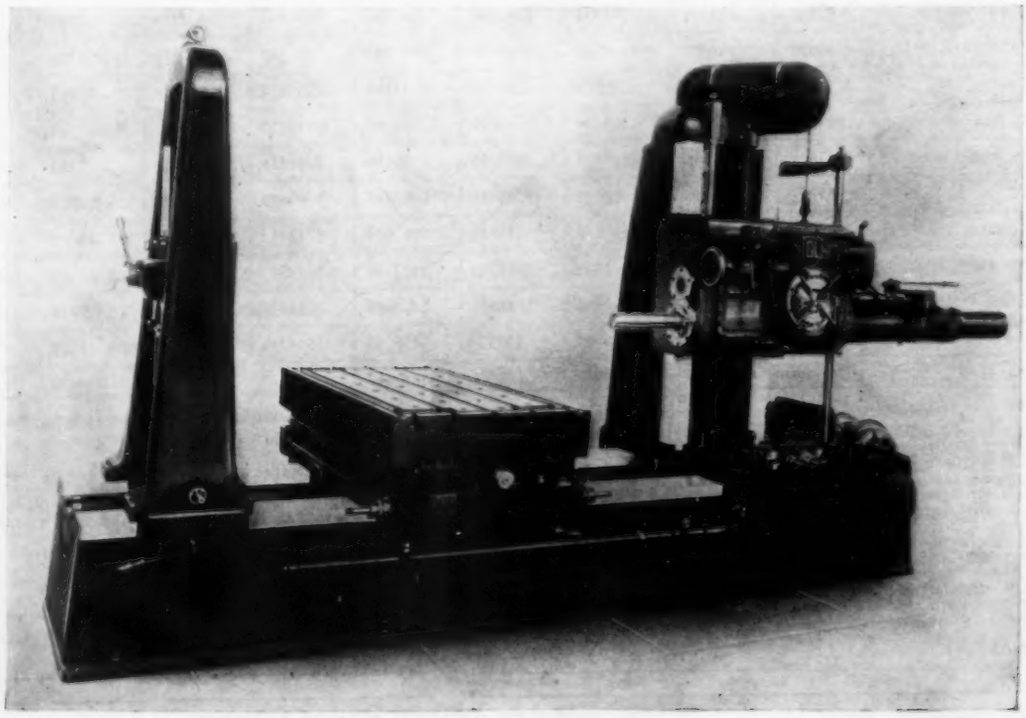
All speed and feed mechanisms for the spindles are compactly built within the inclosed head. The 18 feeds to either spindle are obtainable through a feed unit built on to one of the front cover plates of the head. Taking off this plate removes the complete feed unit for inspection. A rotary change lever controls the nine feed changes, which are indicated on a dial. The back-gear lever connects the rotary gear change lever with another nine feeds. A third lever is provided for changing the direction of the feed. A set of pick-off gears in the feed gear train permits selection of any desired positive lead. A handwheel provided at the upper left of the head gives a slow hand feed to either spindle. Separate clamps permit either spindle to be located for milling.

Power and slow hand feeds to either spindle are automatically thrown out at each end of the spindle travel. An automatic depth gage, which is applicable to either spindle, can be set to automatically throw out the feed at any point within 6 in.

The entire head is automatically lubricated. The bed is of heavy box-type construction, and the semi-steel table is likewise of box construction. Within the front head-end unit of the bed is built a separate feed unit. Milling feeds are obtained from a separate drive shaft ahead of the start, stop and reverse clutches. In this way reversal of the machine does not reverse the feed or rapid traverse. Directional control is provided by levers that are engaged in the direction in which the unit is to move.

Like the No. 70 machine, the No. 30 can be furnished in the table-, planer- and floor types, using the same principal units. A wide selection is offered in the size and travel of the different units. Vertical adjustment of the head on the column is up to 48 in. on all types. Maximum distance between the spindle nose and the end support on the table-type machine can be made as long as required with tables up to 36x72 in.

Additional specifications are as follows: Range of feeds to main spindle, 0.007 to 0.375 in.; range of feeds to

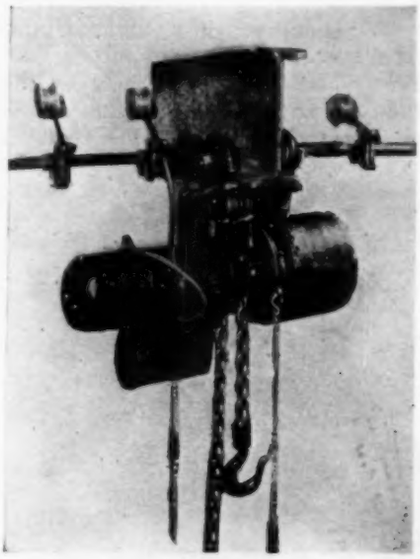


**Giddings & Lewis No. 30 Two-Spindle Horizontal Boring, Drilling and Milling Machine, which employs a 3-in. main spindle and a 2-in. high-speed auxiliary spindle mounted in the back-gear shaft of the main spindle**

auxiliary spindle, 0.002 to 0.125 in.; range of milling feeds, 0.8 to 40 in.; power required, 15 hp., and rapid traverse to all units, 120 in. per min.

## "Mac" Improved Universal Electric Hoist

Improvements have recently been made in the "Mac" universal electric hoist manufactured by the McCollum Hoist & Manufacturing Company, Downers Grove, Ill., in order to increase the efficiency and life of the



**"Mac" Improved Universal Electric Hoist with spring-wheel current collectors for 3-phase circuits**

gearing and to reduce noise. The hoist is made in capacities from 500 to 4,000 lb. and can be had in either the hook or trolley type, the latter being illustrated.

Balanced on either side of the chain sheave are the motor and controller and the gear reduction unit. Either direct or alternating current motors are available for 2- or 3-phase, 60-cycle circuits and with voltages up to 550. The controller box is bolted directly to the under side of the motor frame. In the illustration, a trolley type hoist is shown suspended from an I-beam with three spring-wheel-type current collectors required for 3-phase circuits. Where no intermediate supports for trolley wires are necessary, rigid shoe-type current collectors are available.

The motor drive shaft passes directly through the hollow load sheave into the gear train. In the improved model, the first reduction is through a hardened steel worm and a pair of die-cast, zinc-base alloy worm wheels on either side of the worm, dividing the power and reducing the load per tooth. Then through a pair of spur gears and bevels the power is brought to a single bevel pinion which drives the sun gear of a planet train in which the spider arms are held stationary and the outer ring gear rotated. A load spider transmits the final power to the splined end of the load sheave shaft. A compact construction has been worked out so that the whole gear train is housed in a diameter of 9 in. in all sizes.

The same housing is used for capacities up to 2,000 lb. For the 4,000-lb. unit, an extra trolley is added together with a sheave block at the lower hook, reducing the hook speed in half but doubling the capacity.

## Link-Belt Universal No. 77 Conveyor Chain

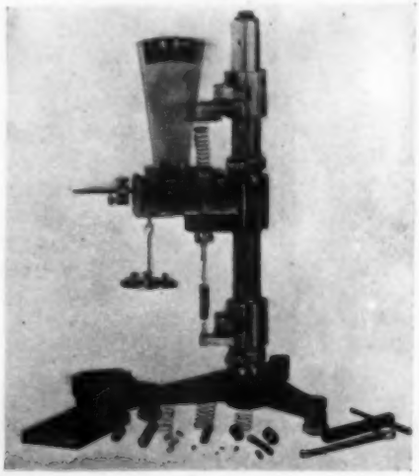
The particular feature of the universal No. 77 conveyor chain made by the Link-Belt Company, 910 S. Michigan Ave., Chicago, is that the chain will curve sideways around corners and "S" curves. It will travel in a horizontal plane around curves of 90 to 180 deg. with freedom under full load and with a curve radius as small as 24 in. Owing to the flexibility of this chain, it may be used on sprockets as small as 7½ in. pitch diameter.

In appearance the Universal No. 77 chain resembles the standard malleable-iron pintle-type, except that the barrel of the link contains a universal joint that permits the side-

wise flexing of the chain. In any position a long bearing of pin and bushing is assured. This chain is particularly suited for light conveyor work.

## "Elasticometer" Type RS 2 Spring Tester

For very accurate compression and extension tests of light springs, such as typewriter and adding machine springs, an "Elasticometer" Type RS2 spring testing machine, has been placed on the market in the United States by the Coats Machine Tool Company, Inc., 110-112 West 40th Street, New York, N. Y. The "Elasticometer" works on knife edges in the same manner as the larger machines. It has a maximum load capacity of 5 lb., and the scale has a 1:1 ratio. From the outer end of the single lever or beam, the weight carrier is suspended, whereas the inner end supports a bar which carries a compression plate or platform above and a tension hook below. A pointer, directly fastened to the beam, completes the weigher scale, which is inclosed in a housing slideably ar-



ranged on the pillar of the machine. Tension and compression tests are made by means of slides. Adjustable stops limit the motion of these slides for quantity inspection.

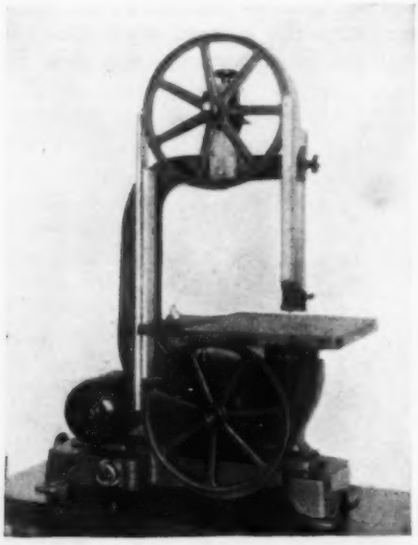
The load is determined by placing loose weights on the weight carrier. Variations in length are read by $\frac{1}{16}$ in. on the vertical length scale. The actual length of the spring in either its free, compressed or elongated state is indicated. Movable tolerance markers for the length are caused to slide in a groove in the pillar. Tolerance markers for the weight are mounted close to the top of the fan-shaped housing and directly over the

scale over which the indicating hand moves.

The maximum open length of compression springs is 6¼ in., and the maximum extended length of extension springs is 8⅝ in., the maximum spring diameter is 1¾ in. Total height of the Elasticometer is approximately 20 in., and the net weight is 27 lb.

## H & A No. 14 Bench Bandsaw

A small motor-driven bench bandsaw suitable for the pattern shop has been developed by Heston & Anderson, Fairfield, Iowa. Several improvements have been made over previous models. It clears 12 in. under the guide and 13¾ in. between blade and frame. This frame is of a one-piece tubular cored construction of



cast iron. Ordinarily, the frame sets on the bench, but can be supplied with a table for floor use.

The rubber-covered wheels are 14 in. in diameter with 1 in. face and are balanced. The upper wheel has a spring arrangement for maintaining the proper tension on the blade, adjustment being by setscrew. Phosphor-bronze bushings are used in both the upper and lower wheel bearings, but ball bearings can be furnished.

By means of a graduated plate the table can be tilted 45 deg. to the right and 5 deg. to the left. It measures 14 x 14 in. and has a 5½ x 8-in. side table attached. The throat plate is of aluminum and is easily renewable.

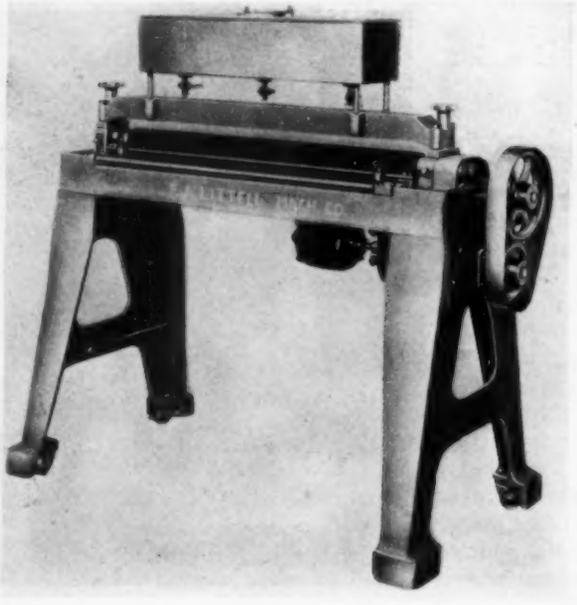
A feature of the machine is the saw guides. The steel pins at the side of the blade are square so as to prevent twisting. Back of the blade on the upper guide is a ball-bearing roller to take the thrust of sawing and insure smooth operation. The lower guide has a hardened pin back of the blade. To prevent the operator coming in contact with the blade, it travels between wooden bars at the rear, and on the front an aluminum guard travels up and down with the guide so that all of the blade not in use is covered. An aluminum wheel guard, not shown, is standard equipment.

Drive is by a ½-hp., ball-bearing motor of the induction-repulsion type. Two 8½-ft. blades are furnished with each machine. The floor space required is 18 x 24 in.; height overall, 48 in. Net weight with motor is 200 lb.

## Littell Power Oiler for Sheet Metal

Sheets up to 36 in. wide and not exceeding 12 gage can be oiled on the power oiling machine announced by the F. J. Littell Machine Company, Chicago, Ill. The operator merely has to push the sheet into the rolls, which thoroughly oil the stock. A wiper removes the excess oil from the sheets.

A ½-hp. motor, in connection with a reducer, is used to feed the sheets at a rate of 100 ft. per min. The oiling rolls are made up of felt washers, which are 1 in. wide. The machine is so arranged that the rolls can be taken out of the machine easily in order to replace the worn washers. Since the machine is mounted on casters, it can be moved to any part of the shop, and the motor can be plugged into an electric light socket.



## Porter-Cable Dustless "Take-About" Sander

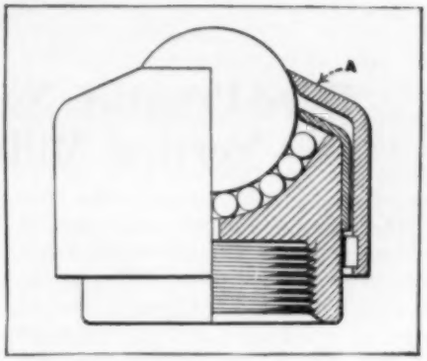
To eliminate dust hazards, the "Take-About" sander built by the Porter - Cable - Hutchinson Corporation, Syracuse, N. Y., is now available with a vacuum-type dust-removal

system. A double-blade fan traveling at 10,000 r.p.m. creates a powerful suction, which draws the dust through ports directly in back of the rear pulley and deposits it in the bag. The dust is removed easily from the bag through the zipper opening. In addition, the bag can be detached easily by a simple twist of the coupling. It not only keeps the air surrounding the workmen clean, but prevents excessive clogging of the abrasive belt, which means faster cutting.

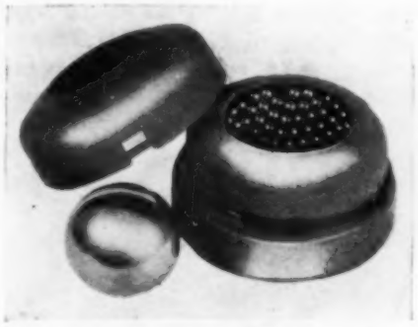
The universal motor is placed horizontally to the frame of the machine to give better balance and to concentrate the weight over the sanding shoe. Power from this 1-hp. motor is transmitted to the rear drive pulley through a hardened and ground worm and nickel-bronze worm gear. An aluminum

operating lever extends from the switch towards the handle to within easy reach of the operator's thumb.

Using the correct abrasive belt, almost any material either flat or curved can be surfaced. Belts can be changed quickly and can be supplied in any grit or degree of fineness. Belt size is 3x27 in., and the speed, using a No. 2 abrasive belt, is 1,030 ft. per min. A bench stand can be furnished with the type B-10 to convert it into an edge sander or grinder.



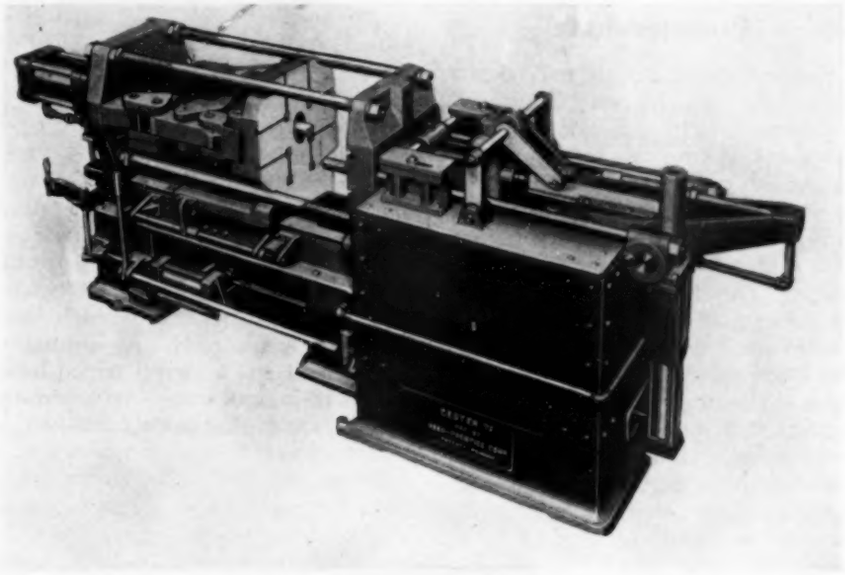

**Cross-section of Mathews Ball Transfer for pipe connection, showing the dirt cap at *A***



**Dirt cap and ball removed from Mathews No. 202 Ball Transfer for pipe connection**

## Lester No. 7F Hydraulic Die-Casting Machine

The No. 7 die-casting machine built by the Reed-Prentice Corporation, Worcester, Mass., selling agent for the Lester Die & Machine Company, Cleveland, Ohio, has been redesigned, the present offering being known as the No. 7F. The machine is now hydraulically operated throughout. The operating links are made of cast steel bushed with hardened bearings and having facilities for lubricating. Two levers at the right-hand side of the machine are furnished, one lever operating the oil mechanism and one lever the air mechanism. The die plates are machined with T-slots, allowing the dies to be mounted quickly in position. An automatically operated hydraulic cylinder can be furnished for ejecting the castings from the dies. Automatic removal of cores during the opening stroke of the machine can also be provided for.



The hydraulically-operated gooseneck is automatically submerged in the metal, allowing it to fill up to a predetermined level. The cylinder for bringing the gooseneck up to position is mounted on the end of the machine, and is operated by a lever convenient to the operator. When the gooseneck is in position, the air connection through the ball and socket is brought into position automatically and is then ready for the operator to apply the air through a second lever.

*Specifications:* Die opens, 8 in.; maximum die space, 17 in.; minimum die space, 6 in.; between bars, 16½x12 in.; shots per hour (average), 250; gooseneck capacity (aluminum), 7.5 lb.; pot capacity (aluminum), 250 lb.; length, 10 ft. 8 in.; height, 50 in.; width, 42 in.; shipping weight, 6,500 lb.

## Mathews Ball Transfer

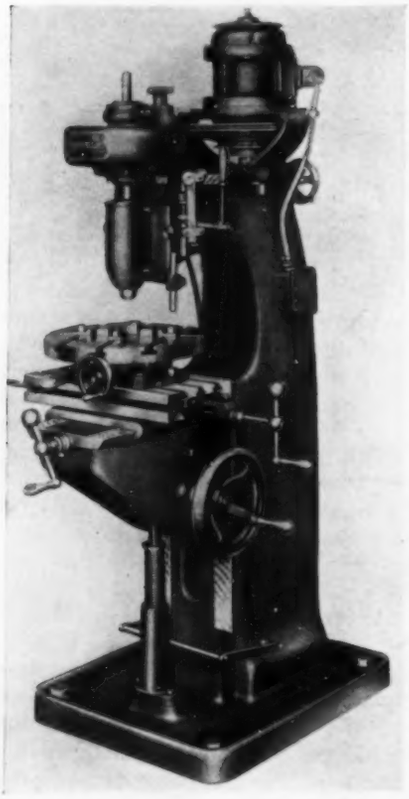
For moving heavy objects in any direction in a horizontal plane, the Mathews Conveyor Company, Ellwood City, Pa., has developed a ball transfer. When mounted in groups on a heavy structural support, this ball transfer forms an effective means for moving heavy shapes to and from shears, for conveying tote boxes to and from a roller or power conveyor, and for handling heavy cores or molds when same are placed on smooth bottom plates. The ball table, as it may be termed when a group of the transfers are employed, will also serve as a turntable for rotating heavy work during machining operations.

A feature of this ball transfer is the dust and dirt cap which rests loosely against the ball. This dust cap is locked loosely in position by a spring retainer. If particles of dirt should get in, a small opening in the bottom of the ball cage permits the dirt to work out.

Ball transfer type 200 is furnished with a 4-in. diam. base and four holes for mounting. The type 201 is furnished with a 3-in. square base with four holes for mounting. The type 202 is furnished with a threaded base for a 2-in. standard pipe. All types have a load rating of 200 lb. each. The type 500 is similar to the type 202, but has a load rating of 500 lb. The base is of drop forged steel threaded for 2-in. standard pipe.

# Reed-Prentice No. 2V Router and Vertical Milling Machine

The No. 2V router and vertical milling machine, announced by Reed-Prentice Corporation, Worcester, Mass., is intended for work on brass, steel and cast iron, and is a redesign of the No. 2 size, which has been found particularly suitable by stamp, stencil and light die manufacturers. A 1-hp. motor can be supplied in three speed ranges, 900, 1,200, or 1,800 r.p.m., to give spindle speeds of 500 to 3,000, 666 to 4,000 and 1,000 to 6,000 r.p.m. Spindle speeds up to 12,000 r.p.m. can be obtained, if



necessary. The drive from the ball-bearing motor is by means of an endless molded V-belt. A spindle pulley brake and lock permits quick stopping of the spindle and ready changing of the collets and cutters.

The sliding head is operated by a clutch handle or treadle. The micrometer depth stop is graduated in thousandths, with a vertical scale graduated to 2 in. and subdivided in tenths. The spindle is provided with a collet sleeve to take either old or new style collets. Drive to the spindle is by means of a four-step, heat-treated, aluminum alloy pulley, combining lightness and strength and reducing inertia when stopping.

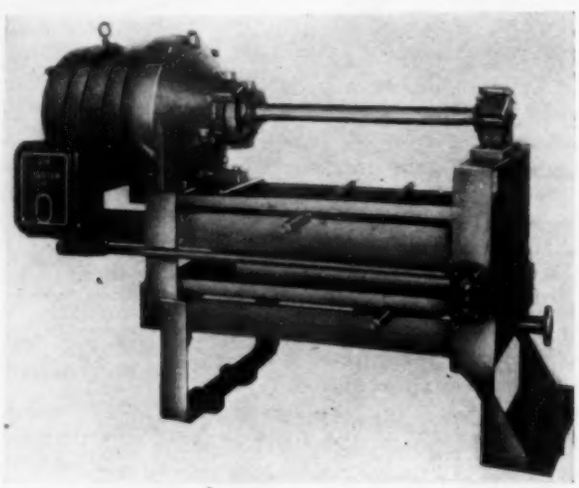
Specifications: Longitudinal feed, 14 in.; cross feed, 11 in.; vertical feed of knee, 15 in.; maximum distance between spindle and table, 17 in.; maximum distance between spindle and frame, 15 in.; working surface of table, 18 x 8⅞ in.; length of carriage, 16½ in.; diameter of rotary table, 15 in.; hole through spindle, ½ in., and net weight, 1,650 lb.

## "One Profit" Motorized Countershaft

For motorizing belt-driven machine tools, the Production Equipment Company, 5219 Windsor Ave., Cleveland, Ohio, is introducing a motorized countershaft available in an overhung type and a box type. It consists of a motorized speed reducer with extended shaft and outboard bearing. The driving pulley is mounted on the extended shaft, and the speed of this shaft is designed to duplicate the speed of the belt-driven countershaft. The unit can be supplied in ratings from ½ to 20 hp., in single or multi-speed designs, and for reversing or non-reversing service. It can be used for single or cone-pulley applications.

The box-type base permits ready mounting of an idler pulley and belt shifter, and is usually supplied with two U-shaped supporting members, which may be mounted directly over the spindle bearing caps. This unit fulfills the requirements of safety codes, as it can be furnished with a mechanical belt shifter and the belt is entirely inside the box construction. Mesh-wire covers for the box can be supplied.

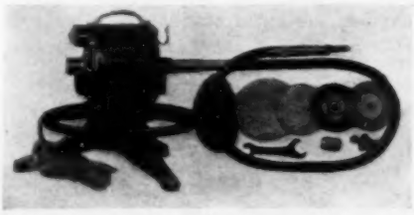
The overhung type of drive is mounted on a welded steel base supported by a structural steel column. The column is bolted to the rear or side of the machine. The countershaft base is hinged on the upper end of the column, and the belt tension is adjusted by means of a simple cam, operated by an adjusting lever. With this type of base the upper part of the machine is kept clear.



**"One Profit" Motorized Countershaft with box-type base, which is mounted on U-shaped supports attached to the machine. A push-button starter is supplied**

## "Wyco" Flexible-Shaft Kit

A low-priced flexible-shaft kit has recently been placed on the market by Wyzenbeek and Staff, Inc., 566 Washington Blvd., Chicago. The

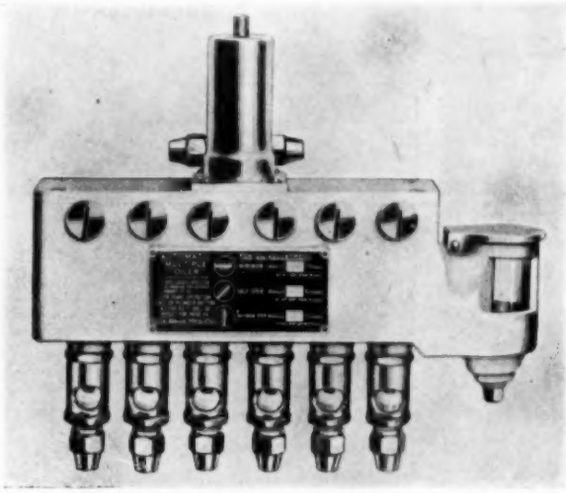


outfit includes a ¼-hp. 60-cycle, a.c. motor with built-in switch, "Wyco" flexible shaft, 4 ft. long, a 6-in. flexible sanding disk, 4- and 5-in. buffing wheels, 4-in. scratch brush, 4-in. emery wheel, ¼-in. drill chuck, wheel arbor, hardened wrench, and 10 ft. of electric cord. As ordinarily mounted, it has a swivel tripod-base, with a 12-in. tool tray. An extension base, 22-in. high, can be furnished.

## Gits Automatic Multiple Oiler With Gravity Feed

Simplicity of construction and non-clogging are the principal features of the automatic multiple oiler announced by Gits Bros. Manufacturing Company, 1846 South Kilbourn Ave., Chicago. Controlled amounts of oil varying from $\frac{1}{4}$ to 10 drops are delivered by gravity to each bearing regardless of the viscosity of the oil, as long as it will flow through passages never less than $\frac{3}{16}$ in. Each oiler is made in eleven sizes having from two to twelve leads, and is intended to be located within 3 ft. of the bearings being lubricated.

It is possible to operate as many as a hundred oilers simultaneously from a single source, and where desirable a different grade of oil may be used in any one of them to suit conditions.



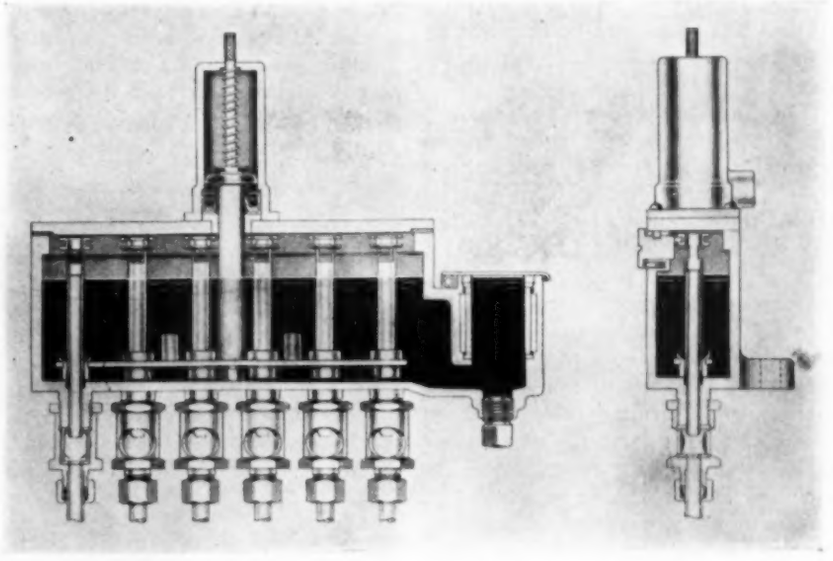
Gits Style MPN Automatic Gravity-Feed Multiple Oiler designed for Pneumatic Operation

Operation can be by air, solenoid, electric motor, link connections to the machine being lubricated, or by hand. Air supply can be taken from service lines through the medium of a reducing valve to bring the pressure down to 30 lb. per sq.in., or a small electrically-driven compressor unit can be supplied. The air is not used to force the oil through the lines, but merely performs the single mechanical action, which is a simple lifting one. Whether this action is accomplished by air piston, solenoid, or geared motor, a separate timing device is required suited to each type, but the timer is omitted if the oiler is operated mechanically.

These timing devices can be set to operate the oilers at intervals of 6, 12, and 24 minutes or up to any interval that is necessary. In cases where three or four oilings a day are sufficient, hand operation is preferable. The timers can be driven by small electric motors or can be belted to the machine being lubricated.

The cross-sectional view shows a pneumatically operated oiler with six leads. Essentially, it consists of a piston and plunger with a cross bar to which six oil cups are attached. Ordinarily these cups rest in the bottom of a clear well of oil, but at selected intervals the crosshead is raised by the air piston to a fixed height and a quantity of oil in each cup discharged through standpipes connected directly to sight feed glasses below whence the connection is made by tubing to the various bearings. By means of adjustable sleeves with slotted ports surrounding these standpipes, the amount of oil fed can be controlled within close limits. Adjustment of each individual sleeve is by a collar engaging a crankpin in the end of a solid stud. The timing device can be set so that the cups are held in the discharge position an interval proportional to the viscosity of the oil, allowing complete drainage at the selected port level.

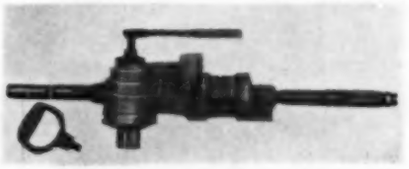
It is possible to operate the oiler by hand at any time or by a remote control switch independent of the timer, to flush the bearings initially, for example, when starting up. All oiler units are equipped with a sight gage and filling cap. The body is aluminum and the fittings brass. Copper tubing $\frac{5}{16}$ in. O.D. is usually furnished and is pushed into the bearing hole and held by a clamp.



Cross-section of the Gits Automatic Oiler showing the simple arrangement of standpipes and feed cups

## Hercules No. 287 Heavy-Duty Drill and Reamer

The Buckeye Portable Tool Company, Dayton, Ohio, has announced the Hercules No. 287 heavy-duty drill and reamer, which is also suitable for nut setting. The weight of this tool is 40 lb. The No. 287-3 drill and the No. 288-3 nut setter have a speed of 120 r.p.m. The No. 287-5 drill and No. 288-5 nut setter have a speed of 68 r.p.m. The drill is equipped with a No. 5 Morse taper socket, and the



Hercules No. 287-5 Drill, which has a speed of 68 r.p.m.

nut setter with a $\frac{7}{8}$-in. square spindle. The feed is controlled by a ratchet wrench. A spade handle or breast plate can be used in place of the ratchet.

## "Maximus" A. M. Sensitive Drilling Machine

For small drilling and other delicate vertical operations, the "Maximus" A.M. sensitive drilling machine is being offered by Adolph Muehlmatt, Cincinnati, Ohio. This bench-type machine is suitable for the laboratory, toolroom and production work. By the application of a universal slide rest, the Maximus can be converted into a universal vertical milling machine.

Four ranges of spindle speeds are obtainable by means of four ranges of motor and spindle pulleys avail-

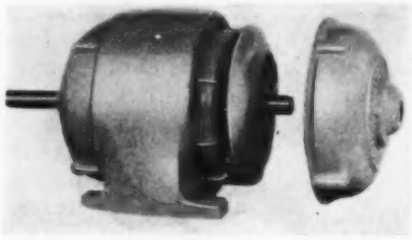
able. Three of these drives are standard and the fourth is special. Speeds up to 3,500 r.p.m. can be obtained as standard and up to 4,375 r.p.m. as special.

The base has a machined surface surrounded by an oil channel and is unusually large for the handling of both work and jigs. Holes can be drilled to the center of a 16 in. circle. The normal vertical capacity of 10 in. between the base and the chuck may be increased to meet special requirements. Vertical adjustment of 7 in. is imparted to the drilling unit by means of a worm, pinion and rack mechanism. A round table $5\frac{1}{2}$ in. in diameter and a 10x6-in. rectangular table, fitted over the round table, are included in the regular equipment.

The motor is mounted on a sliding bracket having a travel of 2 in. Drive is by means of a $\frac{5}{8}$-in. endless flat leather belt. Drilling capacity, $\frac{1}{4}$ in.

## Sterling "Klosd-Tite" Motor

A totally inclosed, fan-cooled motor has been placed on the market by the Sterling Electric Motors, Inc., Telegraph Road at Atlantic Boulevard, Los Angeles, Calif. This "Klosd-Tite" motor has two cast-iron enclosures, the fan drawing air in at the outer end bell and directing it over the inner casing. Lubrication



is facilitated by means of oilers projecting through the outer casing into the inner bearing housing. Long tight fits in the inner casing resist the entrance of vapor into the motor and thus reduce explosion hazards in vapor-charged atmospheres. Lubriseal ball bearings prevent entrance of dirt into the interior.

## Cutler-Hammer Bull. 9115 Manual Across-the-Line Starter

A three-pole, across-the-line, manual starter for a.c. squirrel-cage motors up to 2 hp. is announced by Cutler-Hammer, Inc., 205 N. 12th St., Milwaukee, Wis. This Bull. 9115 starter has the following features: Small size; thermal overload relays; all poles trip on overload; twin-break, silver-to-silver, butt-type contacts;

easy operation, and a cover interlock.

The starter is $4\frac{7}{16}$ in. wide by $8\frac{9}{16}$ in. high by $3\frac{7}{8}$ in. deep. The thermal overload relays operate directly on contact mechanism and open all three poles on an overload. These overload relays employ the same heater coils as other "C-H" starters.

## "Everlock" Lockwasher

Thompson-Bremer & Company, 1640 West Austin Ave., Chicago, Ill., have announced the "Everlock" lockwasher, which has die-formed teeth that are hardened and heat-treated. The shape of the teeth causes the lockwasher to hold the nut firmly even against severe vibration. The illustration shows an unretouched

photograph of a nut which has been screwed down against an Everlock washer, showing in particular the way in which the washer teeth have bitten into the nut.

## Square D Power Filter Unit

For supplying a steady flow of d.c. power from an a.c. supply in relatively large capacities, the Square D Company, Detroit, Mich., has announced a power filter unit. The power supplied is particularly suitable for magnetic chucks and eliminates the necessity for maintenance of motor-generator sets or converters. In addition, the power unit is of such compactness as to permit building it into the base of the machine. Other uses are talking picture equipment and other sound producing apparatus which require a supply of noiseless non-pulsating d.c. power from the ordinary a.c. line. The unit is noiseless and has no hum and no moving parts. It does away with the neces-

Square D Power Filter Unit

sity for storage batteries and dry cells, and avoids the necessity for special circuits and relays for cutting out the a.c. power supply when the system is in operation.

## "Standard" External and Internal Comparators

High precision gaging of parts on a production basis can be done with the line of internal and external comparators announced by the Standard Gage Company, Poughkeepsie, N. Y. The external gage is available with a dial indicator or a fan-shaped scale, as shown in Figs. 1 and 2. The dial scale is graduated to 0.0001 in. in widely spaced divisions, permitting closer estimates, whereas the fan-shaped scale is graduated to 0.00005 in., and may be fitted with tolerance markers.

Optically flat tables with serrated surfaces are furnished with the external gages. These serrations fulfill two purposes: First, prevention of errors through dirt or from minute irregularities in the work surface; and second, prevention of masters clinging to the surface. The table is 4 in. in diameter, and pieces up to 6 in. in height can be accommodated under the direct-acting dial plunger, which is tipped with a diamond in both cases. Final adjustment of the dial to the master is made by vertical adjustment of the table by means of a screw.

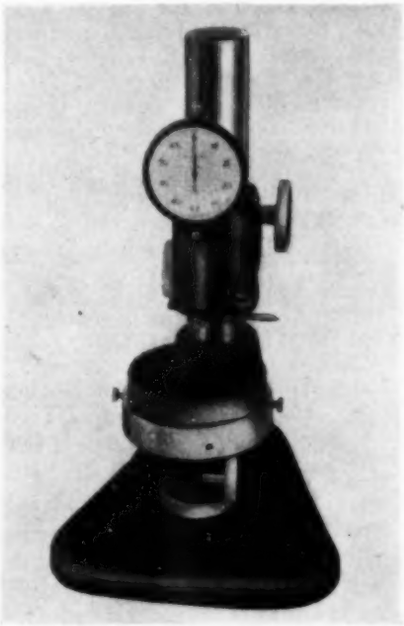


Fig. 1 — "Standard" External Comparator, having a dial indicator graduated to 0.0001 in., and also having a serrated optically flat table

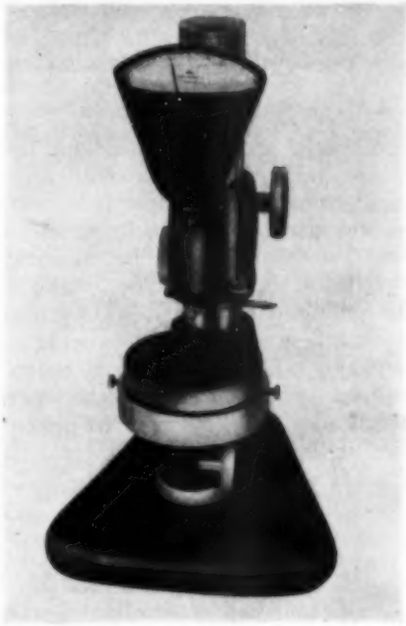


Fig. 2 — "Standard" External Comparator fitted with fan-shaped scale graduated to 0.00005 in.

The internal gage, Fig. 3, is for exploring holes for bell mouth, taper, and out-of-roundness. Ball races and bushings can be quickly checked for the above conditions. The dial is graduated to 0.0001 in. The work is slipped over two arms projecting from the body. The lower arm is stationary, but can be adjusted up or down to accommodate various bores. The upper arm is spring-actuated and has a short vertical movement. The three knife-edges employed, one for the lower arm and one on each side of the upper arm, are made of tungsten-carbide to provide long wear. The indicating lever, which is linked to the dial gage and connected to the upper arm, also carries a diamond gaging point. This diamond point moves along the entire length of the bore when the work is slipped over the arms, and registers any irregularities on the dial. For long bores, the part is reversed on the arms, each half of the bore being checked separately. A collar prevents the work from passing beyond the diamond point. Comparators for bores from ½ to 3 in. and up to 3 in. in length are available

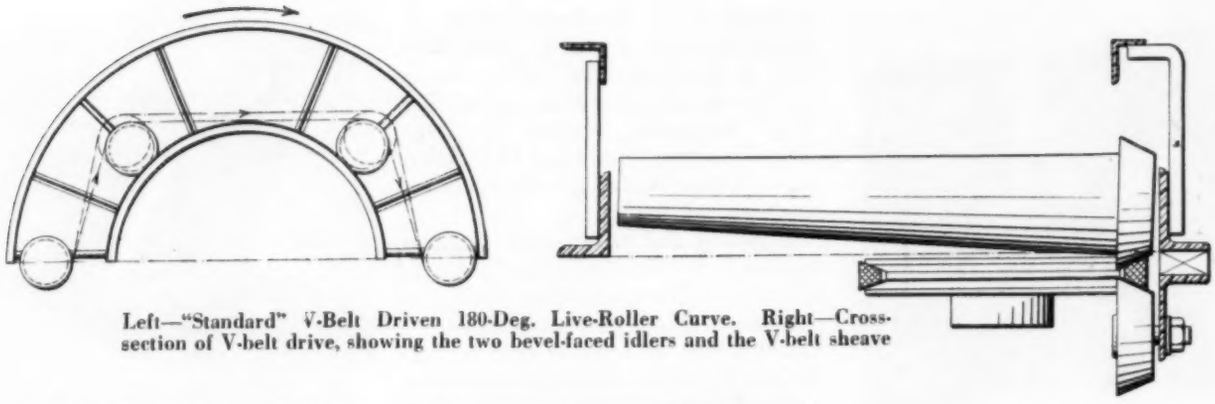
Fig. 3 — "Standard" Bore Comparator for checking bell mouth, taper, and out-of-roundness in ½- to 3-in. bores up to 3 in. in depth

## "Griptite" Rubber-Belt Dressing

Stick-form dressing for rubber belts has been announced by The Diamond Rubber Company, Inc., Akron, Ohio. This "Griptite" dressing is standardized in one size and one package.

The purpose of a dressing on rubber belts is not to lubricate the belt but to make the surface more tacky and thus give a greater traction. It is particularly suitable for belts that have been exposed to dust and to those whose surface has become slightly hardened due to slipping or age.

Applied sparingly it is said that Griptite will double the pulling power of the belt, and that the pulling power increases with time after the application. The belt dressing contains no oil or grease, and no chemicals harmful to the belt or pulley. It is not inflammable. Since it is hard and cannot easily be put on too thick.



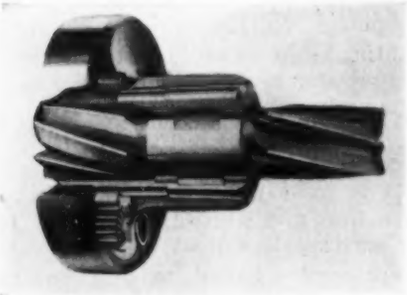
Left—"Standard" V-Belt Driven 180-Deg. Live-Roller Curve. Right—Cross-section of V-belt drive, showing the two bevel-faced idlers and the V-belt sheave

## "Standard" V-Belt Driven Live-Roller Conveyor Curves

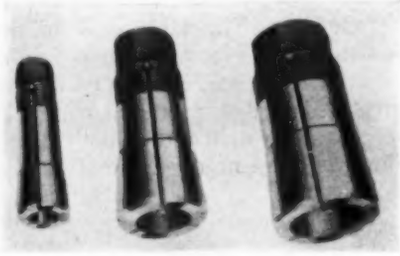
Application of the V-belt drive to a live-roller curve has been made by the Standard Conveyor Company, North St. Paul, Minn. This type of drive makes every roller in the curve power driven. Two bevel-faced idlers, one attached to the roller and the other idling, form the groove in which the V-belt travels. The V-belt drive also assures quiet operation. Both 90- and 180-deg. live-roller curves can be installed.

## "Thurco" Double End Mills, Chucks and Collets

Double service is the feature of the double end mills announced by the Thurston Manufacturing Company, Providence, R. I. If one end requires regrinding or is broken, the tool is quickly reversed and the operator proceeds with his work. A special chuck holds the mill positively and eliminates slipping under the heaviest feeds and speeds. These chucks are made in three types as follows: S-1 for small accurate jobs; S-3 for medium or fair-sized milling, and S-5 for heavy or rigid milling.



"Thurco" Double End Mill, Chuck and Collet Assembly

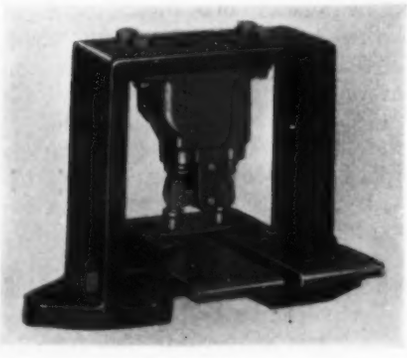


"Thurco" Collets for the Double End Mills

The chucks are standardized for the use of various collets, and all mills are interchangeable. Capacity is based on the size of the chuck, which is made so that it can be mounted directly on the nose of the spindle in the milling machine, and held by four studs, which are driven by two large keyways. The chucks have a centralized tightening device at the front, which allows the operator to tighten the mills quickly when making changes without loosening draw bolts.

## Ross Operating Valves

Foot- and hand-controlled operating valves for pneumatic control have been developed by the Ross Operating Valve Company, 6488 Epworth Blvd., Detroit, Mich. The foot-operated valve is made in two styles, Models D.T. and S.T. The Model D.T. is made in three sizes, $\frac{3}{8}$-, $\frac{1}{2}$- and $\frac{3}{4}$-in. pipe sizes and is mounted in brackets. Foot treadles are cast steel, and all pins, levers and rockers are hardened to insure long service. This model is illustrated in the accompanying photograph. The Model S.T. is made in five sizes, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{4}$ in. It is offered for double-acting service.



The hand-operated valve is made in five sizes—$\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{4}$ in.—for single- and double-acting cylinders and in locking or non-locking types.

# PATENTS

JUNE 2, 1931

**Metal-Working Machinery**

Machine and Tool for Shaving Gear Teeth. Edward W. Miller, Springfield, Vt., assigned to The Fellows Gear Shaper Co. Patent 1,807,665.

Forging Machine. Joseph Lesico, Livingston, Ill., assigned to Sullivan Machinery Co. Patent 1,807,696.

Machine for Sizing and Punching Vehicle Wheel Rims. William N. Booth, Detroit, Mich., assigned to Kelsey-Hayes Wheel Corporation. Patent 1,807,824.

Double Angular Tool Slide. Edward P. Bullard, Jr., Stratford, Conn., assigned to The Bullard Co. Patent 1,807,829.

Metal Working Machine for Molding Strips. Homer G. Kellogg, Detroit, Mich., assigned to Motor Products Corporation. Patent 1,807,847.

Metal Working Machine. Carl C. Grotnes, Chicago, Ill. Patent 1,807,980.

Shearing, Punching and Riveting Machine. Andrew Johnson, Jr., Roseau, Minn., and George F. Worthington, Sr., Chicago, Ill., assigned to Vega Separator Corporation of America. Patent 1,808,041.

Variable Velocity Ratio Mechanism in Worm or Cam Cutting Machine. John George Douglas, Leagrave, Luton, England, assigned to George Kent,

Limited, Luton, England. Patent 1,808,131.

Hydraulic Press. William E. McCullough, Kenosha, Wis., assigned to Simmons Co. Patent 1,808,244.

Welding Machine. Frank L. Sessions, Lakewood, Ohio. Patent 1,808,261.

Apparatus for Grinding Rolls. Oskar Waldrich, Siegen, Germany. Patent 1,808,392.

Crop End Discharging Apparatus. Florence C. Biggert, Jr., Crafton and John A. Smitmans, Pittsburgh, Pa., assigned to United Engineering & Foundry Co., Patent 1,808,396.

Grinding Machine. John Cook, Syracuse, N. Y., and John C. Spence and Raymond A. Cole, Worcester, Mass., assigned to Norton Co. Patent 1,808,401.

Riveting Apparatus. Raymond S. Osborne, Sewickley, Pa. Patent 1,808,431.

Manufacture of Wire Cables. George Zapf, Cologne, Germany, assigned to Felton & Guilleaume Carlswerk, A.G., Koln - Mulheim, Germany, Patent 1,808,444.

Distributing Apparatus for Spoolers on Wire Drawing Machines. Norman H. Nye, Cuyahoga Falls, Ohio, assigned to The Vaughn Machinery Co. Patent 1,808,714.

Grinding and Polishing Lathe. Raymond C. Mitchell, Springfield, Ohio, assigned to The Mitchell Engineering Co. Patent 1,808,728.

**Tools and Attachments**

Turret for Multiple Punching Machines. Ernest Dietrich, Altenburg, Germany. Patent 1,807,652.

Formed Truing Tool for Helicoidal Abrading Wheels. Edward W. Miller, Springfield, Vt., assigned to The Fellows Gear Shaper Co. Patent 1,807,666.

Metal Shearing Apparatus. Alva W. Phelps, Anderson, Ind., assigned to Delco - Remy Corporation. Patent 1,807,671.

Bearing. Charles H. Norton, Plainville, Conn., assigned to Norton Co. Patent 1,807,701.

Tachometer. Edward B. Nowosielski, Bloomfield, N. Y., assigned to Eclipse Machine Co. Patent 1,807,702.

Feeding Mechanism for Riveting Machines. Edwin B. Stimpson, and Joseph F. Suessle, Brooklyn, N. Y., assigned to Edwin B. Stimpson Co. Patent 1,807,941.

Rivet Feed. Edwin B. Stimpson, Brooklyn, N. Y., assigned to Edwin B. Stimpson Co. Patent 1,807,942.

Universally Adjustable Tool Holder. Edward P. McMurtry, Pasadena, Calif. Patent 1,807,999.

Drill Support. Joseph P. Maslewski, Minneapolis, Minn. Patent 1,808,051.

Collapsible Tap. William J. Hogg and Frederick Neumann, Cleveland, Ohio, assigned to The National Acme Co. Patent 1,808,138.

Work Holder. William H. Chapman, Montclair, and Philip H. Hutchinson, East Orange, N. J., assigned to General Motors Corporation. Patent 1,808,288.

Annealing Box. George B. Nisbet, Cleveland, Ohio, assigned to The Otis Steel Co. Patent 1,808,314.

Chuck. Eyvind Finsen, Rochester, N. Y., assigned to Gleason Works. Patents 1,803,346 and 1,808,347.

Dies for Making Bars. George Langford, Joliet, Ill., assigned to McKenna Process Co. Patent 1,808,467.

Welding Torch. Robert T. Gillette, Schenectady, and Edward S. Webster, Troy, N. Y., assigned to General Electric Co. Patent 1,808,541.

**Furnaces**

Expansion Furnace Wall. Oscar Nygaard, Saugus, Mass. Patent 1,807,868.

Pyrometer for Metallurgical Furnaces. Foster M. Poole, Kansas City, Mo., assigned to The Brown Instrument Co. Patent 1,808,507.

**Processes**

Method of Electric Arc Welding. Howard J. Burnish, Milwaukee, Wis., assigned to A. O. Smith Corporation. Patent 1,807,961.

Means for Electric Welding Including the Employment of an Air Current. Ira Walter Day, Waterloo, Iowa, assigned to Associated Manufacturers Corporation of America. Patent 1,807,971.

Process of Pickling Metals. Deal H. Tompkins, Nitro, W. Va., assigned to The Rubber Service Laboratories Co. Patent 1,808,188.

Welding. Manton B. Bryant and Walter J. Beatty, Detroit, Mich. Patent 1,808,205.

System of Heat Treating. Charles A. Martin, Chicago, Ill. Patent 1,808,241.

Method of Reforming Bars. George Langford, Joliet, Ill., assigned to McKenna Process Co. of Illinois. Patent 1,808,466.

Method of Forming Shells. George E. Ireland, Toledo, Ohio, assigned to The City Machine & Tool Co. Patent 1,808,731.

# TRADE PUBLICATIONS

ABRASIVE GRAIN SIZES. The U. S. Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R118-30 entitled "Abrasive Grain Sizes." It is for sale by the Superintendent of Documents, Washington, D. C., for $0.05.

BEARINGS. The Robins Conveying Belt Co., 15 Park Row, New York, N. Y., has issued bulletin No. 81 on the "Robins-Jones Bearing," recently described in these pages. Various applications, specifications, and results of tests are included.

CLUTCHES. The Carlyle Johnson Machine Co., Manchester, Conn., now has available a circular on its single and double clutches and single clutch with pulley, showing a wide variety of applications and the construction.

PATTERN SHOP EQUIPMENT. Heston & Anderson, Fairfield, Iowa, have issued an illustrated bulletin on their woodworking equipment for the pattern shop. The line comprises a bench bandsaw, circular saw table, swinging cut-off saw, bench jointer, spindle shaper, and a lathe.

PRESSES, ALL-STEEL. The Allsteel Press Co., 12015 South Peoria St., Chicago, Ill., has published bulletin No. AS-31 describing the "Verson" arc-welded, steel-plate punch presses. It describes the method of manufacture and advantages, and illustrates the various types of presses and punches.

PYROMETERS. The Brown Instrument Co., Philadelphia, Pa., has published Catalog No. 1101 featuring the line of potentiometer pyrometers recently described in these pages. It gives a concise description of more than 50 new features.

SKID PLATFORMS. The U. S. Department of Commerce, Bureau of Standards, has issued Simplified Practice Recommendation R95-30 entitled "Skid Platforms." It is for sale by the Superintendent of Documents, Washington, D. C., for $0.05.

SPEED REDUCERS AND GEARS. The D. O. James Manufacturing Co., 1120 W. Monroe St., Chicago, Ill., now has available catalog No. 136 on "Continuous-Tooth Herringbone Speed Reducers and Gears." Many installation photographs are given. Complete information on these products and sundries, together with selection tables are given.

VALVES, FUEL OIL. The Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, Pa., has issued bulletin No. 50 describing its oil fuel regulating valve and illustrating several of its features.

V-BELTS. The L. H. Gilmer Co., Tacony, Philadelphia, Pa., has issued a 84-page, 8½ x 11-in. V-belt catalog, which comprises two sections. The first section is devoted to theoretical and practical illustrations of V-belts and their operation in multiple drives, and the second is an engineering data section.

WELDING BOOKLET. The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has available Arc Welding Data Bulletin No. 15, a 16-page publication containing illustrations of many unusual arc welding achievements and explaining with the aid of diagrams the various methods of testing, and discussing the methods for obtaining good welds. The publication is known as D.M.F. 5350.

American Machinist

*Editors:* KENNETH H. CONDIT AND FRED H. COLVIN

**New York, June 11, 1931**

VOL. 74 NO. 24

## *Facts for Drop Forgers*

IN A recent address, Assistant Secretary of Commerce Julius Klein pointed to lack of information as the most important cause of the 1929 depression. He amplified the statement by remarking that no real census of the unemployed in the United States had ever been taken before January 1931, that only as the 1930 census returns are analyzed will we have any conception of the statistics of retailers and retailing.

When it comes to production statistics we are somewhat better supplied with facts, but there are still many industries that are almost totally in the dark and whose executives must make their plans by guesswork. It is particularly gratifying, therefore, to learn of the steps taken by the American Drop Forging Institute to secure through the aid of the Department of Commerce some of the vital facts needed for the profitable conduct of this industry.

*American Machinist* commends this plan without reservation. Its own surveys of obsolete metal-working equipment, in 1925 and in 1930, went far to prove the importance of concentrating on equipment modernization. The more exact information that should result from this survey will provide a useful check on the *American Machinist* inventories. And the data on market trends in types of forgings should be helpful not only to drop forgers but to equipment designers.

The details of the program are outlined in an article on page 906, by C. H. Smith, president of the Institute.

## *The Perfect Peacherino*

ONCE upon a Time there lived a Tool Builder who was One Complete Wise Guy. As wise guys Will, he had an Idea. His Idea, simply Expressed, was to build a Perfect Peacherino for producing Peculiar Parts for the Razzmataz, the Jazzembo, and the Zizzizzle. Burning many a Midnight Mazda, he got the Peacherino all sketched Out. And he Built it, and Tried it, and Changed it, and it cost him Much Coin before it looked Good to him.

Then tucking his Peacherino into a Freight Car, he hied him to the Marts of Trade, where the Razz, the Jazz and the Zizz are made by Big Business Men, Captains of Industry, yea even Tycoons of Great Wealth. They knew the Economic Principle of the Transfer of Thought and Skill from Men to Machines, so they visualized the Value of the Peacherino. And they asked its Price.

Deeply thinking, the Tool Builder said to Himself: "Like a Milling Machine does my Peacherino look; as for a Milling Machine shall I charge." But he Forgot the hours of Building, of Trying, of Changing. And when he told his Prospects the Price, they hid their Smiles while they signed the Orders. So he did a Wonderful Business, making Peacherinos. But it was all Business and No Profits.

But the Razzer, the Jazzer and the Zizzer got men of Low Mentality to run their Peacherinos, and never Worried. And every three months the Razzer, the Jazzer and the Zizzer gleefully Grabbed the Price of a Peacherino in Excess Profits and slipped it into their Jeans. Thus did they pull a Fast One, and then Some, while the Tool Builder sat in the Shadow of the Poorhouse and didn't Know it. Selah!

## *Foundryman and Metallurgist*

FROM the types of papers presented and the discussions from the floor of the Thirty-Fifth Foundrymen's Convention, it was evident to one observer that the key man in the foundry industry today is the metallurgist. The rule-of-thumb man is being more or less relegated to second place.

Questions of sand research, for example, dig much deeper than the average foundryman can follow. X-Ray and gamma ray examination, microphotography, chemical analysis are coming to be considered essential in foundry control. All of these are in the hands of the metallurgist. He is delving into the finer points of foundry practice; the entire metal-working industry is watching him with anticipation and confidence.

# NEWS OF THE WEEK

## Machine Tool Dealers Discuss Sales Principles

Two talks on the basic principles of successful selling and sales management featured the spring meeting of the Associated Machine Tool Dealers at Granville, Ohio, June 4 and 5. The speakers were Carle M. Bigelow of Bigelow, Kent, Willard, consulting engineers and marketing specialists, and R. A. Balzari, head of the Marketing Counselors Staff, McGraw-Hill Publishing Co., Inc.

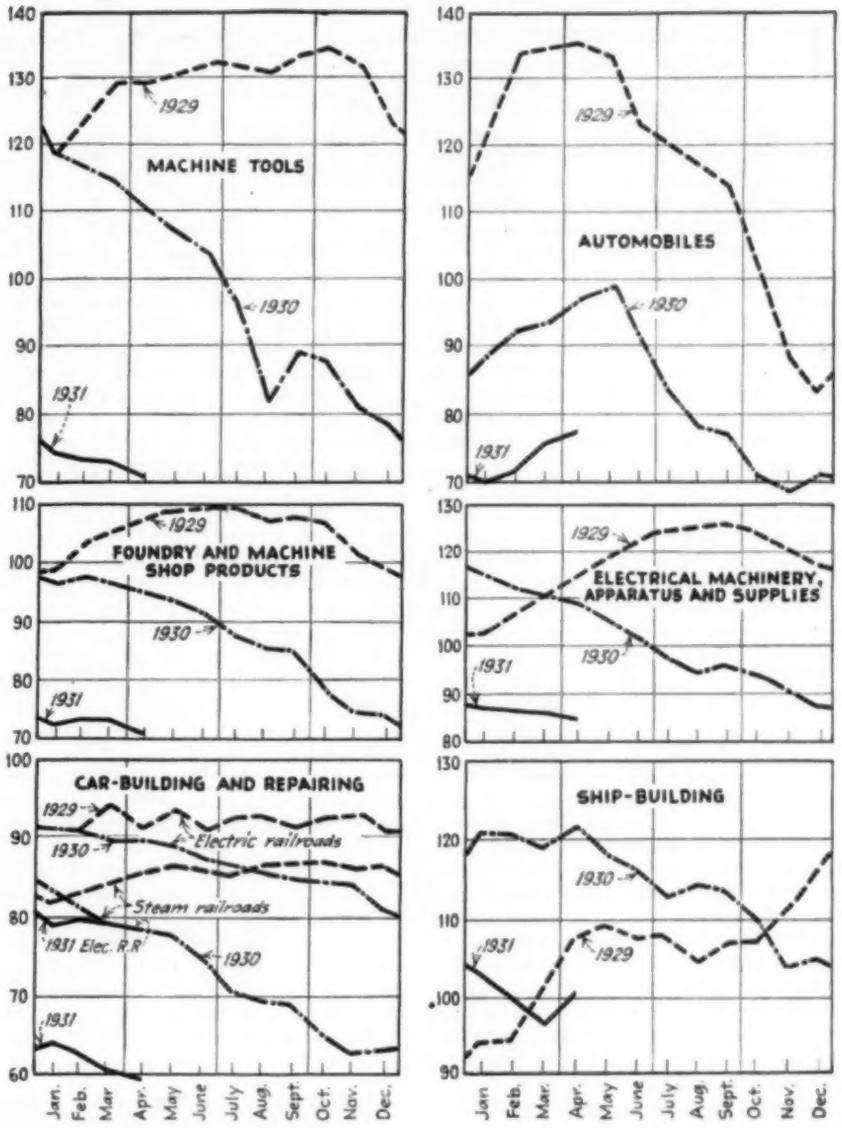
Mr. Bigelow pointed out the importance of breaking every distribution problem down into its simplest elements and then disposing of each element on its merits, regardless of tradition. Mr. Balzari emphasized the necessity of proper balance between the different sales tools, personal salesmanship, direct mail, publication advertising, and selective sales direction. In response to a question he talked for a short time on the training of salesmen, maintaining that the only way to success lies in so presenting new ideas and sales plans that the salesman accepts them as his own and applies them accordingly.

K. H. Condit, editor and publishing director of the *American Machinist*, reported the progress that has been made by the committee of the Associated Business Papers which is sponsoring a general campaign to stimulate industrial buying through the replacement of obsolete equipment in all branches of industry.

J. H. VanDeventer, industrial consultant, the *Iron Age*, stated that the only way to prosperity lies either in increasing average income or reducing average costs of commodities so that the average volume purchased by the consumer may be increased accordingly. One way to accomplish this end is in wider use of modern instead of obsolete equipment.

Robert B. Luchars, publisher of *Machinery*, reported the results of a staff survey of the current practice in equipment buying in large and small machine shops. Superintendents and foremen appear to be the most important factors involved.

In the discussion following Mr. Condit's address, William K. Stamets offered a proposal to accomplish the desired results by setting up a 3-year replacement plan. The plan met with general approval and was thought to have a popular appeal which has been missing from other programs. The meeting indorsed the campaign of the Associated Business Papers and tendered the cooperation of the Associated Machine Tool Dealers when and if requested.




**Trend of Employment in Metal-Working Industries**

**Monthly average for 1926 = 100. Data supplied by the Bureau of Labor Statistics.**

## Standards News

A survey to determine present practice in various plants and industries with respect to the speeds of driving and driven machinery is being made by means of a questionnaire by a committee on speeds of machinery working under the procedure of the A.S.A. Information gained from the questionnaires will form the basis for the development of the proposed program which comprises the establishment of a series of standard speeds of transmission shafting and driven machines, to be based on a standard series of speeds of driving machines; a series of standard diameters of pulleys and of the pitch circles of gears and chain sprockets, resulting in a series of standard transmission ratios; a series of standard widths of pulleys and of belts of different kinds, and a standard pull per inch of width for belts of each kind; a standard series of belt speeds, and a number of tables.

STANDARD tolerance in the thickness of 1/64-in. to 1/32-in. vulcanized fiber sheet approved by the National Electrical Manufacturers' Association is now 0.002 in. This supersedes the former standard of 0.003 in., as published in the NEMA Standards and Specifications for Vulcanized Fiber, Publication No. 31-7, issued in January, 1931.

THE Simplified Practice Recommendation on Packaging of Overhead Electric Railway Material has been issued to industry for acceptance. It is the result of the recommendation adopted at a conference of manufacturers and users in Pittsburgh on May 7.

# Buying Public's Altered Sense of Values Stressed at Management Meeting

THE stimulation of buying power by building extra features into merchandise or by offering staple articles at attractive prices was the advice given manufacturers by L. R. Boulware, general sales manager of the Syracuse Washing Machine Co., guest speaker at the Production Conference of the American Management Association, at Rochester, N. Y., June 1. At the dinner meeting, presided over by James Gleason, president of the Gleason Works, Mr. Boulware stated that products must be designed from the standpoint of consumer's wants or the creation of new wants. The manufacturer must also recognize an altered sense of values in the buying public. He must exercise constructive imagination to meet these demands successfully. The speaker pointed out that the value of plant equipment depends on its quantity compared to the use for it. The manufacturer can no longer market what he has designed, but must reverse the process, and determine what he can make that the consumer demands.

W. F. Coleman, vice-president of the W. A. Jones Foundry & Machine Co., presided at the Monday morning session. In presenting a paper on "The Effect of Design on Overhead," O. D. Reich, vice-president of the Dexter Folder Co., emphasized the need of cooperation between the design and manufacturing departments. He recommended a processing committee to put this cooperation on a working basis. During the discussion, the tendency of some designers to be autocratic was criticized. The feasibility of premium payments for design was brought out; it was shown that such payments involved distinguishing between invention and routine design.

Thomas R. Jones, vice-president and general manager, Harris-Seybold-Potter Co., talked on "Engineering and Shop Standardization." He stressed the many possibilities for standardization and the high return resulting therefrom, citing many instances to prove his points. In one company 1,640 sizes and varieties of steel were reduced to 160 by careful analysis. Men who are not too close to the picture are often best suited for this work.

John Gaillard, of the American Standards Association, told of the advances being made in national and international standardization. This country, he said, receives a lot more credit for standardization than it actually deserves. Standardization has been too largely the development of a few large companies and not a general acceptance.

At the Monday afternoon session with E. S. LaRose, Assistant Comptroller of Bausch & Lomb, presiding, a paper on "The Relation of Building and Equipment Design and Layout to Overhead Reduction," was read by W. J. Austin, president of the Austin Co. The new "windowless" plant of the Simonds Saw & Steel Co. was described in some detail.

E. C. Brandt, assistant works manager of the Westinghouse Electric & Manufacturing Co., talked on "The Relation of Machine and Equipment Layout to Overhead Costs." By a series of lantern slides, he showed departments in the Westinghouse plant before and after revising machine lineups, and told of the corresponding savings. In replying to questions, Mr. Brandt said an assurance of three years production was the minimum necessary to justify re-equipment.

Edward A. Halblieb, president of the Delco Appliance Corporation, presided at the Tuesday morning session. A paper, "Reduction of Fixed Charges by the Use of Three Shifts," was read by James G. Marshall, general superintendent of the Union Carbide Co. He outlined a method of 24-hour operation which overcame most objections.

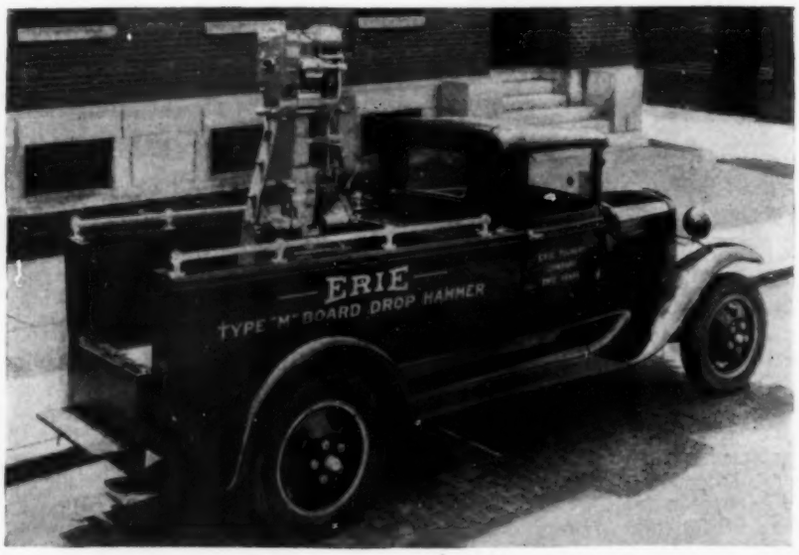
In the absence of the scheduled speaker, Percy Brown, of the James O. McKinsey Co., presented the topic "Organization for the Elimination of Indirect Labor and Clerical Effort." In the past, the efficiency of direct labor has been stepped up; now equal attention must be given other manufacturing costs.

At the afternoon session on Tuesday, H. H. Lang, comptroller of the Stecher Lithographic Co., presided. C. S. Carney, vice-president of the Trundle Engineering Co., spoke on "The Costs of Indirect Expense during Seasonal and Cyclical Fluctuations of Business." He advocated a reserve to absorb losses from idle productive capacity during dull periods.

Raymond S. Perry, assistant to the president, The Ingersoll Milling Machine Co., described "The Methods to Bring Under Control the Ever-Increasing Ratio of Indirect to Direct Effort." For the larger concern, said Mr. Perry, the remedy lies in control through cost standards for overhead departments. Smaller concerns should obtain much of their repair work and special service through outside contractors. This may be extended to the functions of design and tool engineering. The manufacturer's desire to be self-contained was among the objections raised to this policy.

## A.S.M.E. Power Division Meets in Madison

Sessions of the annual meeting of the A.S.M.E. Oil and Gas Power Division will be held June 23-26 in the new Mechanical Engineering Bldg., University of Wisconsin, Madison. Included in the papers are: "Dispersion of Oil Sprays," "A Quiescent Combustion Chamber," "Experiments on the Flow of Air Through Engine Valves," "Development of a High-Speed L-Head Diesel Engine," "How to Select a Diesel Engine," "Development of Double-Acting Diesels," "Experience with an Automatic Diesel Plant," "Diesel Municipal Light Plants in the Middle West," "Observation of European Diesel Developments," "European Trends in Diesel Design," "Diesels for Motor Trucks," "Application of Oil Engines to Ship Propulsion," "Light Alloy Pistons and Rods in High-Speed Industrial Engines," "Piston Packing Problems," "Outstanding Municipal Diesel Plants," "Heat Recovery from Internal Combustion Engines."




**This quarter-size model of a 3,000-lb. Erie board drop hammer is used for working demonstrations in the plants of prospects. Self-containedness, a sales feature on the full-sized units, is capitalized in the model, which is operated simply by connection to a light socket**

# Hartford Entertains A.S.M.E.

HARTFORD "did itself proud" in handling the Fourth New England regional meeting of the A.S.M.E., June 1-3, sessions including applied mechanics, education and training, machine shop practice, power, aeronautics and management. Entertainment was ample, varied and interesting, and included a banquet at which Clayton R. Burt presided, Don L. Brown was toastmaster and the speakers were Walter S. Paine, Roy V. Wright and E. E. Wilson. President Wright stressed the necessity for a working plan for industry if the present system is to exist and pointed out the need for engineers and management to face the future together. E. E. Wilson traced the history of the air-cooled aviation engine and outlined some of the real advances that have been made in aviation.

Foreman and apprentice training had a lively inning at one of the sessions. Frances Perkins, Industrial Commissioner of New York Department of Labor, and John A. McCarthy, State Supervisor of Trade Education in New Jersey, both had excellent papers that showed how management's task was becoming more difficult as the years go by. Neither apprentice nor foremen training get the quality or quantity of attention they deserve, not alone for the boys and men involved, but for industry itself. The hopeful thing is that keen minds are giving the subject more thought than ever before and that the individual qualities and capacities of the workers are being considered. One of the discussors, a small shop manager, quoted statistics to show that 80 per cent of failures could be traced to inefficient shop management. In some sections there is an encouraging cooperation between industry and the schools.

Nine cutting fluids used by Prof. Boston and Carl Oxford in the drilling tests showed surprisingly uniform results, while dry cutting and the use of plain water seemed to have little effect on either torque or thrust. The paper evoked a lively and varied discussion on the use of sulphur and oleic acid in the cutting oils (Abstracted *AM*—page 859, Vol. 74).

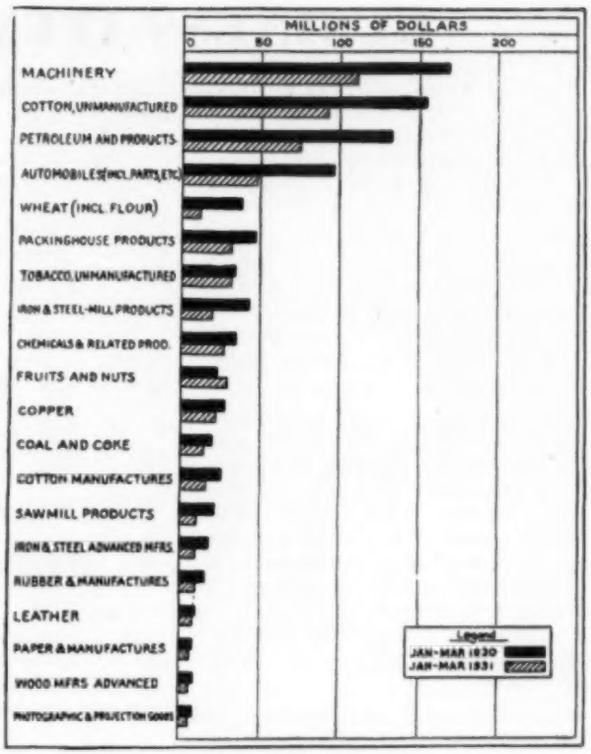
Alloys and heat-treatment affect machinability to a marked degree in shallow cuts, according to T. G. Digges who showed that vanadium, chrome, nickel and molybdenum steels all machined more readily than plain carbon steels (*AM*—page 859, Vol. 74).

Airplane design, engine manufacture and the recent 6,000-mile flight over Central America occupied the aeronautical section, while several power problems also had a session of their own. The Pratt & Whitney Aircraft Corporation and the Chance Vought Corporation were visited, as was the Pratt & Whitney Co. and other plants.

Gages and gaging had a session of their own. Papers by E. J. Bryant and T. F. MacLaren have been abstracted (*AM* — page 859, Vol. 74).

Both textiles and springs had sessions of their own while management, under the chairmanship of E. P. Bullard, discussed stabilization of employment. Howell Cheney felt that wages must be reduced to meet world competition and to increase production. Flanders pointed out many loop holes in such an argument and suggested a 40-hr. week with heavy bonuses for overtime work as a check on management's desire to overproduce. Coes felt that the centralization and a better knowledge of costs would help maintain more uniform production. Webster advocated a fluctuation of man hours to keep employees at work, while Doty wanted huge bond issues with heavy gasoline, stamp and check taxes to build public improvements. Davis of Stevens Institute felt that now was the time to invest in more educational facilities, especially in the lower grades, while Rastall pointed out the need of an equipment policy by various industries, using the U. S. Steel Co. as an example.

Wednesday afternoon a group of fifty assembled to exchange ideas on formulas for the selection and replacement of manufacturing equipment. Harold V. Coes presented the background of the work concisely and introduced Prof. F. E. Raymond and H. Vorlander of Massachusetts Institute of Technology who are engaged in making a special study of the problem under the auspices of the A.S.M.E. and the A.S.A. Following the presentation of their informal progress report, a lively discussion brought out valuable ideas on the economic factors which govern the purchase of new equipment, on what constitutes obsolescence and on the form that a replacement formula should take for maximum acceptance and utility. Prof. Raymond made it clear that suggestions and cooperation will be welcomed.




**United States exports of leading commodities, first quarters of 1930 and 1931**

## New Canadian Tariff

Items in the new Canadian tariff which affect American exports extensively include certain steel lines, higher-priced automobiles and parts, agricultural products, machinery, canned goods, magazines, and furniture and other wood products. The duty on grinding machines, etc. has been raised from 25 to 30%, machinery not otherwise provided for from 30 to 35%, iron and steel manufactures not otherwise provided for 30 to 35%, turbo-generator sets 700 hp. and greater 20%, passenger automobiles retailing for $1,200-$2,100 from 27½ to 30%, and higher priced automobiles from 27½ to 40%.

ESTABLISHMENT of a single Court of Patent Appeals is proposed by the American Engineering Council in a report of its Patents Committee. Such a court, it was declared, would substantially stimulate inventing, and would protect both the patentee and the public from enormous financial waste. The National Association of Manufacturers has approved the proposal now under advisement by various committees of patent law associations.

A $2,500 prize contest to determine the most practical plan of employer-employee relationship for American business has been announced by Forbes magazine. The prizes will consist of $1,000 for the best plan submitted, $300 for the second best plan, $200 for the third best, and $1,000 to the employee fund of the company using the plan adjudged the best.

A GENERAL conference on the simplification of Wire Screen Cloth will be held at the Hotel Biltmore, New York, N. Y., on June 18.

# BUSINESS ITEMS

Plans for consolidation of the Foote Brothers Gear & Machine Co., and the Dodge Manufacturing Corporation into a $10,000,000 organization, to be known as the Dodge-Foote Corporation, have been announced.

The Toronto Industrial Commission announces the incorporation of the Baldor Electric Co. of Canada, Ltd., which will manufacture in Toronto fractional-horsepower electric motors. The parent company is the Baldor Electric Co., St. Louis, Mo.

Officials of the LaVelle Foundry Co., 1740 West Michigan St., Indianapolis, have announced reopening of the plant after a suspension of nearly two years. Receipt of new orders caused the officials to decide to move the equipment from another plant at Anderson to Indianapolis and accept the orders. Officials say they have every reason to believe there will be a gradual increase in the foundry business. T. A. LaVelle is president.

Announcement is made by the Victor Talking Machine Co. of Canada, Ltd., that reconstruction of the Victor plant in the St. Henri district of Montreal is practically completed and ready for the manufacturing equipment, much of which is now on hand and being installed.

The Pacific Hoist & Derrick Co., Seattle, has opened a Portland (Ore.) branch at 320 E. Oregon St. with William E. Henry as manager. This firm has represented the Northwest Engineering Co., manufacturer of power shovels, in the Washington territory and recently was appointed direct distributor throughout the Pacific Northwest.

The American Gill Screw Co., Providence, R. I., has completed a one-story machine shop addition with new equipment.

The Ludington Boat Corporation, East Greenwich, R. I., has begun production.

The White Co., Cleveland, Ohio, manufacturer of White trucks and buses, opened a plant in Montreal, Que., June 1, at 5225 De Gaspe St.

Ideal Metal Products, Inc., will manufacture a general line of metal stampings in Worcester, Mass.

The Apex Stamping Co., Inc., Crawfordsville, Ind., was sold at public auction on June 5 by the Industrial Plants Corporation of Ohio.

Wright's Canadian Ropes Ltd., Vancouver, B. C., Canadian branch of Wright's Ropes Ltd., Birmingham, England, has bought out the Vancouver Wire Ropes Works Ltd., Industrial Island, Vancouver, and will in future operate this concern as a Western Canadian branch of its organization. T. A. Taylor will probably be appointed president.

Several changes in the officers and additions to the board were made at the annual meeting of Canadian Vickers Co. W. W. Butler, president of Canadian Car & Foundry, and J. E. Labelle, a director of the Canadian National Railways, were made directors. D. B. Carswell, formerly general manager and latterly managing director, was made a vice-president.

The Clyde Iron Works, Duluth, Minn., is now manufacturing a complete line of hoisting engines and derricks in Canada and has appointed F. H. Hopkins & Co., Ltd., Montreal and Toronto, as distributor in Eastern Ontario, Quebec and the Maritime provinces.

# PERSONALS

The Quad-City Foundrymen's Association at its annual meeting, has elected E. A. Gullberg, Union Malleable Iron Works, Moline, Ill., president; Charles Scherer, Davenport Machine & Foundry Co., vice-president and S. M. Brah, Moline, secretary-treasurer. Mr. Brah holds a similar position with the Tri-City Manufacturers' Association. Directors for the year are: P. T. Bancroft, Hyman Bornstein, Charles Demmlar, R. L. Eichman, A. E. Hageboeck, F. W. Kirby, A. D. Matheson, John H. Ploehn and E. W. Rice.

Paul T. Cherington, formerly director of research of the J. Walter Thompson Co., New York, N. Y., is establishing offices at 2316 Chanin Bldg., 122 East 42d St., New York, N. Y., as a consultant on distribution.

Jasper Elliot Crane, vice-president of E. I. duPont de Nemours & Co., Wilmington, Del., has been elected president of the Princeton Engineering Society.

T. C. Clarke, of the Northern Electric Co., Ltd., Winnipeg, has been elected president of the Manitoba Electrical Association.

Frederick M. Feiker, formerly managing director of the Associated Business Papers, and before that time an executive of the McGraw-Hill Publishing Co., has resigned to become Director of the Bureau of Foreign & Domestic Commerce, Washington, D. C. He will succeed William L. Cooper, who will return to London as commercial attache.

W. H. Crawford, president of the Reliance Manufacturing Co., Massillon, Ohio, now the Reliance division, Eaton Axle & Spring Co., Cleveland, has been placed in charge of Reliance plants in Massillon and Detroit.

George M. Finkes of the Capital Die Tool & Machine Co., Columbus, Ohio, has been elected president of the Industrial Executive Club, Columbus.

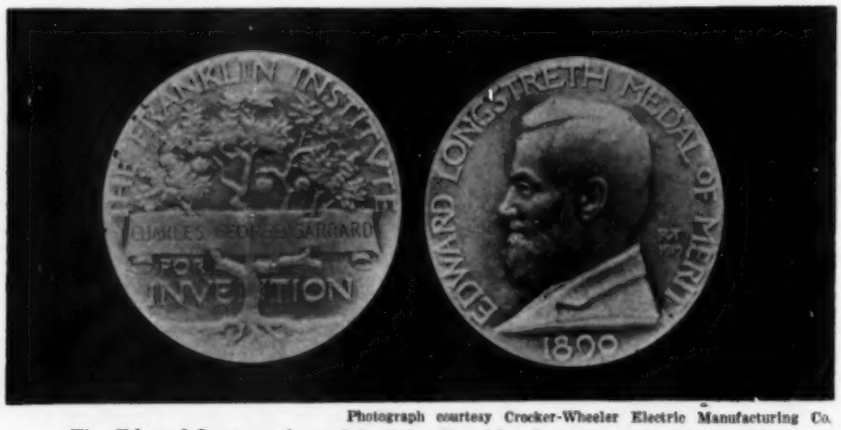
Harrison Hoblitzelle has been elected executive vice-president in charge of operations at the Granite City, Ill., and Eddystone, Pa., plants of the General Steel Castings Corporation, with headquarters at Eddystone. John H. Lock, with Commonwealth since 1912, has been advanced from assistant general manager to general manager of that division to succeed Mr. Hoblitzelle.

A. D. Hunt, formerly manager of engineering at the South Philadelphia works of the Westinghouse Electric & Manufacturing Co., has been transferred to the Chicago office to be engaged in steam apparatus activities in the western districts.

Prof. H. M. Jacklin of the School of Mechanical Engineering, Purdue University, has been elected chairman of the Indianapolis branch, Society of Automotive Engineers.

A. B. Kinzel, metallurgist, Union Carbide & Carbon Co., talked on "Recent Developments in Structural and Engineering Steels," at the June 8 meeting of the New York chapter, A.S.S.T.

Otto Lutherer, research engineer at the laboratory of the American Gas Association for the past 4½ years, has been appointed chief engineer in the gas and oil combustion equipment division of the North American Manufacturing Co., Cleveland.




Photograph courtesy Crocker-Wheeler Electric Manufacturing Co.

**The Edward Longstreth medal of the Franklin Institute, recently awarded to Charles G. Garrard of Thorn, England, for his invention of a speed reducer. The Garrard reducer is of the adhesion type with hardened steel rollers rolling in contact with one another in a bath of oil.**

George B. Karelitz has been appointed acting manager of the Mechanics Division of the Westinghouse Research Laboratories, to fill the vacancy caused by the recent promotion of John M. Lessells to the South Philadelphia Works of the company. Mr. Karelitz joined Westinghouse in 1923, and was research engineer when he left last September to accept a place on the engineering faculty of Columbia University.

Charles N. Liqued has been elected vice-president and works manager of the Chance Vought Co., East Hartford, Conn. Mr. Liqued was in charge of the construction of the new East Hartford plant.

Charles R. McConner has been appointed sales manager of the Clarage Fan Co., Kalamazoo, Mich. Mr. McConner was connected with Clarage from 1920 to 1928, and was for seven years of this time Chicago branch manager. Since 1928 he has been branch manager in Detroit for the Carrier-York Corporation.

Harold P. Mueller, formerly vice-president and director of sales of the L. J. Mueller Furnace Co., Milwaukee, has been elected president and general manager to succeed his father, the late L. J. Mueller, Jr., who was president and treasurer. Paul E. Mueller has been elected to the newly created office of chairman of the board. Gustave C. Mueller continues as vice-president, and Joseph Schlueter has been elected secretary and treasurer.

Tom J. Muir, assistant sales manager for the last three years of the Morgan Engineering Co., Alliance, Ohio, has been appointed director of sales. He has been with the company for 29 years. A. T. Davis has been made sales manager. He has been with the company for 19 years.

Frank C. Pickard, for the past eight years general works manager of the Standard Stoker Co., Erie, Pa., has resigned, effective June 1. He will retain connection with the company in an advisory and consulting capacity.

George E. Prentice, president of the George Prentice Manufacturing Co., Kensington, Conn., has been elected vice-president of the Berlin Savings Bank to succeed the late Ernest Mildrum.

Thomas Pritchard, superintendent of the A. M. Byers Co. plant at Girard, Ohio, for 30 years, has been transferred to Ambridge, Pa., where the company has opened its $10,000,000 plant for manufacturing wrought iron pipe by the Aston process.

F. E. Ross has been elected president and general manager of the American Furnace & Foundry Co., and the American Boiler & Foundry Co., Monroe, Mich., to succeed E. C. Watson, who resigned about a month ago. Charles W. Steidle has been named secretary-treasurer to succeed Mr. Ross.

C. E. Skinner, assistant director of engineering of the Westinghouse Electric & Manufacturing Co., has been appointed as representative of the A.S.A., on the Council of the International Standards Association.

Thomas Temple, formerly superintendent at DeKalb, Ill., for the American Steel & Wire Co., Cleveland, and for more than 15 years superintendent at Birmingham, Ala., plant, will become superintendent of the company's two plants at Joliet, Ill., July 1.

J. H. Wallis has relinquished active management of the Dominion Welding Engineering Co., Ltd., Montreal, to become general manager of the Dominion Hoist & Shovel Co., Ltd., a new subsidiary of the Dominion Bridge Co., Ltd.

C. Wilson Jr., vice-president and general manager of the Harrisburg (Pa.) Pipe & Pipe Bending Co., has been placed in charge of the sales department. H. W. Bishop Jr., has resigned as general sales manager.

## OBITUARIES

Arthur S. Martin, 46, head of the Firthite and engineering departments, Firth-Sterling Steel Co., McKeesport, Pa., died recently in Pittsburgh.

Albert Norton Abbe, 71, director and vice-president of the American Hardware Corporation, New Britain, Conn., died there May 29 of a cerebral hemorrhage.

John T. Arnold, formerly general manager and superintendent of the Attica, N. Y., plant of the Westinghouse Manufacturing Co., died at his home there May 31.

Harry W. Bundy, manufacturer and inventor of automotive equipment, died of heart disease June 2 at his summer home on Upper Lake Michigan.

Martin C. Furstenau, 61, naval architect, who designed the first "super-tugboats" used in the Panama Canal, died June 3. He designed and built the first steam ferry for railroad cars and one of the earliest oil-burning passenger vessels.

Arthur Mason, 61, pioneer automobile manufacturer and a founder of both the Buick and Chevrolet companies, died May 27 of pneumonia after a three-day illness in Flint, Mich.

Ernest A. Palmer, 68, secretary-treasurer of the Arkwright Finishing Co., Providence, R. I., and founder of the Palmer Tracing Cloth Co., now merged with the Arkwright Company, died at Seekonk, R. I., June 3.

Phillips S. Rinaldo, 54, President of the Flexible Steel Lacing Co., 4607 Lexington Ave., Chicago, died May 30.

George T. Rowland, 55 president of William & Harvey Rowland Co., Frankford, Pa., maker of automobile springs, died May 16 at Detroit.

Orville C. Skinner, president of the Lewistown (Pa.) Aircraft & Airways Inc., and retired head of the Standard Steel Works, a subsidiary of the Baldwin Locomotive Co., Philadelphia, died unexpectedly May 19. He had been in ill-health for some time.

## FORTHCOMING MEETINGS

NATIONAL ASSOCIATION OF FOREMEN —Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from headquarters, Refiners Bldg., Dayton, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS —Summer meeting, June 14-19, White Sulphur Springs, Va. Green Brier Hotel. J. A. C. Warner, secretary, 29 West 39th St., New York City.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., N. Y. C.

THE INDUSTRIAL INSTITUTE—Silver Bay on Lake George, N. Y., August 10-25. Charles R. Towson, secretary, 347 Madison Ave., New York, N. Y.

NATIONAL METAL CONGRESS AND EXPOSITION — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS —National Production meeting, Detroit, Mich., Oct. 7-8. Headquarters, 29 West 39th St., New York, N. Y.

NATIONAL SAFETY COUNCIL — 20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., Chicago.

SOCIETY OF AUTOMOTIVE ENGINEERS —National Transportation meeting, Washington, D. C., Nov. 10-12. Headquarters, 29 West 39th St., N. Y. C.

# THE INDUSTRIAL REVIEW

**Weekly progress of the machinery and machine tool business**

## NEW YORK

Last week's machinery and machine tool market was quiet. Some dealers received acceptances on their bids for the 20-tool Bloomfield (N. J.) school list, which was spread out among dealers as widely as possible. No big buyers are in the market, and none are expected until fall. Railroad lists, issued some time ago, have been held up indefinitely, and nothing definite has been heard of the Schenectady school list or the expected list of lathes from the Brooklyn Navy Yard. Prices are, however, holding, an indication that the next change will be upward. Used tools are slow, even at sacrifice prices.

## DETROIT

With the summer decline in the automobile industry growing more pronounced, any immediate hopes of machinery and machine tool dealers for an increase in their business have been dissipated. Most dealers report unusually poor business for May. In a great many cases the month was the worst experienced in several years and at least a few dealers report it the worst in a dozen years. A few motor car manufacturers are going strong but most are cutting down production.

Unless the next few weeks bring some unexpected development, the summer will be even more depressed than the spring, and the outlook for the third quarter is not particularly encouraging. In other periods of dullness during the last few years, machinery men have been able to fall back on municipal prospects but in this case communities are buying practically nothing.

## SAN FRANCISCO

The close of the month of May finds conditions in the machine industry slightly improved over those of April. Consolidated machinery cars delivered in San Francisco this month show a marked increase in tonnage. While sales in some lines have increased, others have fallen off; for instance, road-making machinery is not being sold in the quantity it was last fall. A canvass of some of the local houses shows that some heavy orders have been recently placed with machine tool manufacturers in Ohio. Many of these are government orders or for schools, there being few for commercial projects. One firm reports having booked at least fifteen orders during the last ten days for metal-working machinery —milling machines, lathes, etc. A carload of power pumps is also en route. Some business is expected as result of the Western Pacific and Great Northern activities in northern California. While it is true that orders do not grow on trees, machinery houses in general are holding their own.

## CINCINNATI

A few machine tool manufacturers had a shade larger sales, but the great majority had business at its former level. General opinion is that there will be no further recession, but nobody is making a prediction as to when the sales curve will begin to ascend. Local selling agents are holding their own in the matter of sales and are developing some prospects that they regard as good. Nearly all of the week's orders were for single tools, and in most cases these were for replacement purposes. Business was well diversified as to sizes and types of requirements and was well scattered over the country, consisting in the main of single orders, placed by general machinists and miscellaneous users. A fair volume of inquiries was received, the majority being from miscellaneous small users and for single items.

**MACHINE TOOL and machinery markets continue their slow, uneventful course, endeavoring to improve their condition despite the apathy of general business. In several cases improvement has occurred, notably in San Francisco, Cincinnati, and in Canada. Other districts had a May off from April, and expect June to show little if any change either way. Prices are holding; used tools are going slow, even at sacrifice prices.**

**NEW YORK'S market was quiet, one school list being closed, but little else worth mentioning appearing. Detroit reports unusually poor business for May, and expects the summer to bring a further decline, unless something develops in automobile changes. San Francisco, on the contrary, had a slight improvement in May, most of the business now booked being municipal or school items. Cincinnati manufacturers in general held even, though a few showed upturns. Selling agents are holding their own. Indianapolis is selling special machinery, but no machine tools of any importance.**

**NEW ENGLAND had a quiet week. Some houses expect a summer pick-up; the majority place it later on. Chicago demand for May was also off, railroads having completed their lists, and no new lists being projected. Canada's decided industrial upturn is resulting in tool sales to a variety of industries; the trend of general Canadian business appears to be upward. Southern District sales, on the contrary, slipped off a little. Small tool sales are holding well, but larger items are not going as well as they have been.**

## INDIANAPOLIS

Dullness continues to rule in the local machinery and machine tool market. Just at present there is little prospect of revival until late fall at least, and there are some who profess there are no encouraging features on the horizon even then. Some demand continues for special machinery from the sand and gravel and the crushed rock industry, though sales volume now is falling off. Sales of road contractors' equipment have been fairly good this spring. Sales of special equipment to the refrigerator factories are hardly as heavy as they were earlier, but some are being made. Some coal mine equipment is being sold and some inquiries are being made.

Railroads have no lists out now and division officials here say there is mighty little equipment to be purchased this summer. The automobile industry also is virtually out of the market, though some scattering orders are being received.

## NEW ENGLAND

The machine tool industry experienced a quiet week with but few bright spots to relieve the monotony. A few houses look forward to a summer pick-up, but the general consensus rules against substantial improvement before Fall. Cancellation of some fine orders with indefinite hold-up tags on others did much to disturb morale.

During the week the Electric Boat Co., Groton, received a contract for the submarine "Cuttlefish" to cost $3,297,000 and will employ hundreds of men to assure completion in 30 months. Chance Vought and Pratt & Whitney Aircraft companies added orders for 10 planes (former company) and 30 engines (latter) totaling $273,527. Recent orders for grinding machines run to 50 or 60 units mostly foreign. A radial drill was included in the week's sales, and Boston Navy Yard closed bids June 9 for hydraulic testing machinery.

## CANADA

The decided upturn in industrial operations in practically all economic areas of the Dominion has resulted in a better demand for machinery and machine tools during the last fortnight. Conditions are more satisfactory in the steel trades; increased demand is reported for structural steel for bridge building and for iron for the railway rolling stock industry. The automotive industry is stepping up production at a good rate, and replacement parts are in good demand. Orders for equipment for new factories and plants, principally in Ontario and Quebec, are steadily increasing, and inquiries in this connection indicate a satisfactory volume during the remainder of the year. Manufacturers of hydraulic machinery are working at capacity to keep up with the unprecedented demand from this field.

## SOUTHERN DISTRICT

Sales of machinery and machine tools the past fortnight failed to come up to expectations, with recessions particularly noted in the unit volume of machine business. Small tool sales, for the most part, continued unchanged. There appeared no real center of activity, and the outlying districts of Atlanta, Birmingham, New Orleans and Houston were reported as quiet. Railroads and shipyards throughout the district have made relatively little inquiry, although individual machine shops have no reason to complain. While jobbers find it hard to make replacements, there is some "building up" of old equipment reported.

Road construction has been favorable in both Louisiana and Texas, but the indirect effect on the machinery and machine-tool trade has not been as great as ordinarily had been anticipated. The oil fields of Texas and North Louisiana are quiet.

## CHICAGO

Business for May is reported to have fallen somewhat below that of April. Machine tool demand has dropped to a lower level than has been experienced in several months, and prospects for an upturn before fall, if then, are not regarded as particularly bright. The consequence of this situation is a feeling not far removed from pessimism. Notwithstanding present conditions, however, the hope prevails that the worst has passed, and that any change in the business chart must of necessity be upward. Western railroads are reported to have closed on most items included in their 1931 lists, and are making no new inquiries of importance. Dealers in used tools report occasional requests for standard units of shop equipment.

# BUSINESS • BAROMETER

## *Markets of the world were improved in tone at the end of last week*

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WEDNESDAY, June 3, was Derby Day in England. It is not a national holiday, but it might well be for the whole British Empire stops work while it awaits news of the great race. No precise estimates of the amount wagered on the race is obtainable, but a London dispatch published in the New York *Times* last Thursday said: "It is estimated that the backers and owners of sweepstakes tickets won $100,000,000 on the successful horse named Cameronian." Those who are supposed to be well informed in such matters insist that this is probably an under-estimate of the amount wagered on the race through the Calcutta sweepstakes, the Irish Hospitals sweepstakes, and other agencies which provide facilities for taking a chance.

Certainly the far flung interest which the event attracted does not indicate that the financial collapse of the British Empire impends. This aspect of the event is commended to the pessimists who insist that Great Britain is decadent financially as well as politically. There is, however, no denying that the unprecedented interest in the Derby and the huge sums that changed hands on the race have made a deep impression in stock exchange circles on both sides of the Atlantic. A good many are now beginning to ask whether we can have a really genuine depression in business at a time when the Anglo-Saxon peoples of the world are willing to risk hundreds of millions upon horses that are to them but little more than names.

However this may be, it is undeniable that the markets of the world were improved in tone at the end of last week. In New York the trend of prices on the Stock Exchange reversed itself on the afternoon of June 3, when most of the commodity markets also commenced to show an improvement. The turn was so sudden that it surprised nearly everyone, and it remains to be seen whether it will be permanent or not.

In the past, such a general and sudden reversal in the markets has rarely proved to be permanent, and a somewhat prolonged period of dullness has usually preceded the inevitable change in tendency. Perhaps the present may be one of the exceptions which proves the rule, for, it is undeniable that attention has been forcibly re-directed to the cheapness of commodities as well as to the decline in securities, although there is no pre-arranged schedule upon which it is possible to calculate the movement of prices.

Bank clearings and carloadings, which are about the only available indicia of our domestic trade, both continue to show a reduction as compared with last year. In dealing with these figures it should, however, be borne in mind that the total of bank clearings has been much diminished by the many bank consolidations consummated during the last two or three years, and that part of the reduction in carloadings is due to the efforts that the railroad companies are making to increase the total freight carried in each car. This has gone so far that companies are now being formed to consolidate shipments of less than carload lots, and the time may come when the density of the train load on long hauls will show a further and substantial increase.

This probability is worth the consideration of the many investors who are now selling well-seasoned high-class railroad stocks upon the theory that the motor truck and the flying machine have put an end to the prosperity of the American railroads. This is possible, but the present generation will probably continue to be dependent upon the railroads for most of its transportation requirements, and it seems unwise to assume that the great railway systems of the United States will become valueless in the near future.

Reports from the larger business centers of the United States seem to indicate a slight increase in commercial activity. It is evident that the present disposition is to buy rather than to sell, and a sensational reduction in stocks is now being rapidly effected at lower prices. National Cotton Week has been celebrated with aggressive enthusiasm.

Other staples have shown a slightly improved tendency. Rubber is higher. Silk is somewhat steadier, and there is a better demand for iron and steel. Copper is still in the trough of the depression, although its future seems to be largely dependent upon the action of the powers that now control the bulk of the world's copper production.

A continued improvement in the demand for automobiles is reported from Detroit, and an increased inquiry for building material as well as skilled labor is now commencing to make itself felt throughout the middle and eastern states, and some parts of the west.

It may be premature to say that the turn has come, but it must come some time, and with call money at 1½ per cent, no one of experience will be surprised if the business barometer soon begins to rise to the level that indicates fair weather.

Early in the week some alarming reports with regard to financial affairs of various South American countries were circulated. They seemed to emanate from London, where inquiry has failed to reveal any great concern over the financial situation in Latin America.

### THE BUSINESS WEEK

*June 10, 1931*

**Swings of stock-market sentiment are capricious, but they have become crucially important for business recovery because they now control the congealed currents of credit. . . . The beginning of a major bull movement would be the rarest thing in June during a depression year, unless the business improvement since December has been mysteriously underestimated. . . . The current trade statistics are of no special significance save as showing sustained resistance to further radical recession and an early onset of the usual summer slackness. . . . Our index has shaded off slightly during May, and is back to the level of the beginning of the year. . . . Commodity price declines continue, and wheat has settled sharply to expected open market levels as Farm Board support is withdrawn and the new crop starts to move. . . . But neither commodity nor security quotations now reflect economic actualities, and rational revaluation is inevitable. . . . Those who recognize this early will not regret it. . . . The acute contraction of credit purchasing power and the accompanying crimp in confidence are now the controlling factors, and the pressure of the unprecedented plethora of gold supplies increased by continued imports must soon correct this condition. . . . The disposition of banks to loan a little more on security collateral, and of government to lay off a leading oil merger and let business build bulwarks against price demoralization are the first pale pink bullpoints in a color-blind bear market.**

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# THE WEEKLY PRICE GUIDE . . . .

### *Rise and Fall of the Market*

THE quantity of steel now being produced is so close to that actually being consumed, that a market condition exists which should be highly sensitive to the slightest change for the better. Already, inquiry is increasingly active for structurals, pipe and reinforcing material. Certain grades of scrap iron tend higher. Stocks, of course, remain low. There were no advances, during the week, in materials listed here. Declines occurred in steel sheets, copper, tin, zinc, fabricated brass and copper, solder, scrap non-ferrous metals and linseed oil.

*(All prices as of June 5, 1931)*

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI: | |
| Ala. Foundry (Silicon, 1.75@2.25) | $14.19@$14.69 |
| Tenn. Foundry (Silicon, 1.75@2.25) | 14.19@ 14.69 |
| NEW YORK: | |
| Buffalo No. 2 Fdry. (Silicon, 1.75@2.25) | 19.91@ 20.41 |
| BIRMINGHAM: | |
| No. 2 Foundry (Silicon 1.75@2.25) | 12.00@13.00 |
| PHILADELPHIA: | |
| Eastern Pa., No. 2x (Silicon, 2.25@2.75) | 17.76 |
| Virginia No. 2 (Silicon, 1.75@2.25) | 22.29 |
| Basic | 17.00@17.25 |
| CHICAGO: | |
| No. 2 Foundry, Northern (Silicon, 1.75@2.25) | 17.50 |
| No. 2 Foundry, Southern | 17.01 |
| PITTSBURGH: | |
| No. 2 Foundry | 17.50 |
| Basic | 16.00@16.50 |
| Bessemer | 17.50 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.00 |
| Cleveland | 4.75 |
| Cincinnati | 4.40 |
| New York | 4.75 |
| Chicago | 4.50@4.75 |

**STEEL SHEETS**—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

| Blue Annealed* | Pittsburgh Mill | Chicago | Cleveland | New York |
|---|---|---|---|---|
| No. 10 | 1.85 | 3.35† | 3.00 | 3.20‡ |
| No. 12 | 1.90 | 3.45† | 3.10 | 3.25‡ |
| No. 14 | 2.00 | 3.55† | 3.20 | 3.30‡ |
| No. 16 | 2.10 | 3.65† | 3.30 | 3.40‡ |
| Black | | | | |
| Nos. 18 to 20 | 1.95@2.05 | 3.60† | 3.40 | 3.30 |
| No. 22 | 2.10@2.20 | 3.75† | 3.55 | 3.45 |
| No. 24 | 2.15@2.25 | 3.80† | 3.60 | 3.50 |
| No. 26 | 2.25@2.35 | 3.90† | 3.70 | 3.60 |
| No. 28 | 2.40@2.50 | 4.05† | 3.85 | 3.75 |
| Galvanized | | | | |
| No. 10 | 2.05@2.10 | 3.65† | 3.20 | 3.35 |
| Nos. 12 to 14 | 2.15@2.20 | 3.75† | 3.40 | 3.40 |
| No. 16 | 2.25@2.30 | 3.85† | 3.50 | 3.50 |
| No. 18 | 2.35@2.40 | 4.00† | 3.65 | 3.65 |
| No. 20 | 2.55@2.60 | 4.15† | 3.80 | 3.80 |
| No. 22 | 2.60@2.65 | 4.20† | 3.85 | 3.85 |
| No. 24 | 2.75@2.80 | 4.35† | 4.00 | 4.00 |
| No. 26 | 3.00@3.05 | 4.60† | 4.25 | 4.25 |
| No. 28 | 3.25@3.30 | 4.85† | 4.50 | 4.50 |

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

**WELDED STEEL PIPE**—Warehouse discounts are as follows:

| | New York | | Cleveland | | Chicago | |
|---|---|---|---|---|---|---|
| | Black | Galv. | Black | Galv. | Black | Galv. |
| 1 to 3 in. butt.. | 56.14% | 43.6% | 53.3% | 42.3% | 57.3% | 44.8% |
| 3½ to 6 in. lap.. | 52.72% | 40.18% | 50.8% | 37.8% | 53.9% | 41.4% |

List prices on which foregoing discounts apply, are as follows:

| Size, Inches | List Price per Foot | Diameter in Inches—External | Diameter in Inches—Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .275 | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .585 | 2.875 | 2.469 | .203 |
| 3 | .765 | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | .226 |
| 4 | 1.09 | 4.5 | 4.026 | .237 |
| 5 | 1.48 | 5.563 | 5.047 | .258 |
| 6 | 1.92 | 6.625 | 6.065 | .28 |
| 8 | 2.50 | 8.625 | 8.071 | .277 |

**SEAMLESS STEEL TUBING**—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

| Thickness | | Outside Diameter in Inches | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | ½ | ⅝ | ¾ | ⅞ | 1 | 1⅛ | 1¼ |
| Inches | B.w.g. | Price per Foot | | | | | | |
| .035 | 20 | $0.15 | $0.16 | $0.17 | $0.18 | $0.19 | $0.21 | $0.23 |
| .049 | 18 | .17 | .18 | .19 | .20 | .21 | .23 | .25 |
| .065 | 16 | .19 | .20 | .21 | .22 | .23 | .25 | .27 |
| .083 | 14 | .20 | .22 | .23 | .24 | .25 | .27 | .29 |
| .095 | 13 | .21 | .23 | .25 | .26 | .27 | .29 | .31 |
| .109 | 12 | .22 | .24 | .26 | .27 | .28 | .30 | .32 |
| .120 or .125 | 11 | .23 | .25 | .27 | .28 | .29 | .31 | .33 |
| .134 | 10 | .24 | .26 | .28 | .29 | .30 | .32 | .34 |

**MISCELLANEOUS**—Warehouse base prices in cents per lb.:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Spring steel, light* | 4.50 | 4.65 | 4.65 |
| Spring steel, heavier | 4.00 | 4.00 | 4.00 |
| Coppered bessemer rods | 7.00 | 6.00 | 6.15 |
| Hoop steel | 3.55† | 4.00 | 3.65† |
| Cold rolled strip steel | 4.95 | 6.00 | 6.10 |
| Floor plates | 4.65† | 5.00 | 5.00† |
| Cold fin., round or hexagon | 3.40 | 3.40 | 3.35 |
| Cold fin., flat or square | 3.90 | 3.90 | 3.85 |
| Structural shapes | 2.90† | 2.95 | 3.00† |
| Soft steel bars and bar shapes | 2.90† | 2.95 | 2.90† |
| Soft steel bands | 3.20† | 3.20 | 3.10† |
| Rivets, structural or boiler | 4.00 | 4.00 | 4.00 |
| Tank plates | 2.90† | 2.90 | 3.00† |
| Bar iron (2.75 at mill) | 2.90 | 3.00 | 2.90† |
| Drill rod (from list) | 65% | 55% | 60% |

*Flat, $\frac{3}{16}$-in. thick by $\frac{3}{4}$-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—$\frac{3}{32}$, 8.35c. per lb.; $\frac{1}{8}$, 7.85c. per lb.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

## METALS

Warehouse prices in cents per lb. for small lots:

| | | | |
|---|---|---|---|
| Copper, electrolytic, New York | | | 9.75 |
| Tin, Straits, pigs, New York | | | 24.00 |
| Lead, pigs, E. St. Louis | 3.60 | New York | 4.75 |
| Zinc, slabs, E. St. Louis | 3.20 | New York | 4.50 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony, slabs | 9.00 | 10.00 | 10.75 |
| Copper sheets* | 18.12½ | 18.12½ | 18.12½ |
| Copper wire* | 10.00 | 10.12½ | 10.12½ |
| Copper, drawn, round* | 16.62½ | 16.62½ | 16.62½ |
| Copper tubing* | 20.62½ | 20.62½ | 20.62½ |
| Brass sheets, high* | 16.62½ | 16.62½ | 16.62½ |
| Brass tubing, high* | 20.50 | 20.50 | 20.50 |
| Brass rods, high* | 13.87½ | 13.87½ | 13.87½ |
| Brass wire, high* | 16.12½ | 16.12½ | 16.12½ |

*Mill, base.

# SHOP MATERIALS AND SUPPLIES

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminum ingots, 99%, f.o.b. | 23.30 | 23.30 | 23.30 |
| Zinc sheets (casks) | 9.00 | 10.50 | 10.50 |
| Solder (½ and ½) | 20.37½ | 21.50 | 16@18 |
| **Babbitt metal, delivered in case lots, New York, cents per lb.:** | | | |
| Genuine, highest grade | | | 41.50 |
| Commercial genuine, intermediate grade | | | 32.75 |
| Anti-friction metal, general service | | | 28.00 |
| No. 4 babbitt, f.o.b. | | | 9.00 |

**NICKEL AND MONEL METAL**—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

| | Nickel | Monel Metal |
|---|---|---|
| Sheets, full finished | 52.00 | 42.00 |
| Sheets, cold rolled | 60.00 | 50.00 |
| Strip, cold rolled | 55.00 | 45.00 |
| Rods, hot rolled | 45.00 | 35.00 |
| Rods, cold drawn | 50.00 | 40.00 |
| Tubing | 75.00 | 65.00 |
| Angles, hot rolled | 50.00 | 40.00 |
| Plates | 52.00 | 42.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound, f.o.b. cars:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible copper | 6 50 | 7.50 | 5.50@ 6.00 |
| Copper, heavy, and wire | 5.75 | 7.00 | 4.75@ 5.25 |
| Copper, light, and bottoms | 4.75 | 6.00 | 4.50@ 5.00 |
| Heavy lead | 2.50 | 3.25 | 2.00@ 2.50 |
| Lead battery plates | 1.12½ | 2.00 | 1.25@ 1.50 |
| Brass, heavy, yellow | 3.00 | 4.25 | 3.00@ 3.25 |
| Brass, heavy, red | 5 00 | 6.75 | 4.25@ 5.00 |
| Brass, light | 2.00 | 3.25 | 2.50@ 2.75 |
| No. 1 rod-brass turnings | 3.75 | 4.50 | 3.00@ 3.25 |
| Zinc | 1.00 | 1.50 | 1.00 |

**TIN PLATES**—Charcoal—Bright—Per box:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| "AAA" Grade: | | | |
| IC, 14x20 | $12.10 | $11.95 | $11.50 |
| "A" Grade: | | | |
| IC, 14x20 | 9.70 | 9.90 | 9.50 |
| Coke Plates—Primes—Per box: | | | |
| 100-lb., 14x20 | 6.45 | 6.10 | 7.00 |
| Terne Plates—8-lb. Coating—Small lots—Per box: | | | |
| IC, 14x20 | 7.75@8.00 | 7.00 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.07@$0.11 | $0.13 | $0.13 |
| Cotton waste, colored, per lb. | .05½@.09 | .09 | .09 |
| Wiping cloths, colored, per lb. | .10 | .08 | .09 |
| Sal soda, per lb. | .01½ | .02 | .02 |
| Roll sulphur, per lb. | .028 | .03 | .04 |
| Linseed oil, raw, in 1 to 4 bbl. lots, per lb. | .092 | .099 | .096 |
| Cutting oil, about 25% lard, per gal | .65 | .60 | .60 |
| Machine oil, medium-bodied, per gal | .33 | .28 | .21 |
| Belting—Discounts from list: | | | |
| Leather—List price, 24c. per lin.ft., per inch of width, for single ply: | | | |
| Medium grade | 30–10% | 30–10% | 50% |
| Med. grade, heavy wgt | 30% | 30 –5% | 40% |
| Rubber transmission—List price, 6-in., 6 ply, $1.83 per lin.ft.: | | | |
| First grade | 60-10-10% | 50–10% | 60% |
| Second grade | 70-10% | 60– 5% | 65% |

## *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.029 | $0.029 | $0.0325 |
| Cold fin. shafting | per lb. | .034 | .034 | .034 |
| Brass rods | per lb. | .1375 | .1537½ | .18 |
| Solder (½ and ½) | per lb. | .2037½ | .2087½ | .2525 |
| Cotton waste, white | per lb. | .07@.11 | .07@.11 | .13 |
| Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia. | per 100 | 4.36 | 4.59 | 4.59 |
| Lard cutting oil | per gal. | .65 | .75 | .65 |
| Machine oil | per gal. | .33 | .35 | .33 |
| Belting, leather, medium | off list | 30–10% | 30–10% | 30–10% |
| Machine bolts, up to 1x30 in., full kegs | off list | 65% | 65% | 50–10% |

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets: | | | |
| Flint paper* | $6.03 | $6.03 | $6.03 |
| Emery cloth* | 20.31 | 25.87 | 25.87 |
| Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100: | | | |
| Paper† | 2.61 | 2.61 | 2.61 |
| Cloth† | 4.36 | 4.59 | 4.59 |
| Fire clay, per 100 lb. bag | 1.00 | .75 | .75 |
| Coke, prompt furnace, per net ton | | Connellsville, | 2.40 |
| Coke, prompt foundry, per net ton | | Connellsville, | 3.25 |
| White lead, dry | 100 lb. kegs | New York, | 13.25 |
| White lead, in oil | 100 lb. kegs | New York, | 13.25 |
| Red lead, dry | 100 lb. kegs | New York, | 13.25 |
| Red lead, in oil | 100 lb. kegs | New York, | 14.75 |

*Less than 3 reams. †Less than 200.

## SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

| | |
|---|---|
| Machine bolts: | |
| Up to ¾-in. x 6-in., full kegs, list less | 65% |
| Larger, up to 1 x 30-in., full kegs, list less | 65% |
| Less than full kegs or case lots, add to list | 10% |
| Fitting-up bolts: list less | 45% |
| Lag screws: | |
| Up to ½-in. x 6-in., list less | 65% |
| Larger, list less | 65% |
| Less than full keg or case lots, add to list | 10% |
| Rivets: | |
| Structural, round head, full kegs, net | $4.00 |
| Structural, round head, broken kegs, net | 4.50 |
| Tank, 7/16-in. dia. and smaller, list less | 65% |
| Nuts: | |
| Hot pressed, square or hexagonal, blank or tapped: | |
| Full kegs up to 1-in., incl., list less | 65% |
| Larger, up to 3-in., list less | 65% |
| Less than keg or case lots, add to list | 10% |
| Washers: | |
| Wrought, full kegs, per 100 lb., list less | $4.00 |
| Wrought, broken kegs, per 100 lb., list less | 2.00 |
| Turnbuckles: | |
| With stub ends, list less | 20–10% |
| Without stub ends, list less | 55% |
| Chain: | |
| Proof coil, base, per 100 lb., net | $9.50 |
| Cast iron welding flux, per lb., net | .35 |
| Bronzing flux, per lb., net | .50 |

# MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

## Equipment Wanted

**Ill., Winnetka**—Bd. of Education—manual training equipment for proposed 4 story addition to high school. Estimated cost $750,000.

**N. Y., New York**—Bd. of Education, W. C. Martin, Supt. of School Bldgs., Flatbush Ave. Ext. and Concord St., Brooklyn—will receive bids until June 15 for shop equipment, tools, equipment and supplies in shops at new public School 98, Boston Rd. and East 173rd St. here.

## Opportunities for Future Business

**Calif., Los Angeles**—Maine Machine Works, Central Ave. and 109th St., awarded contract for a new 1 story, 100 x 120 ft. machine and pattern shops, etc. Estimated cost $45,000.

**Calif., Oakland**—G. R. Borrmann Steel Co., Fourth and Grove Sts., is having plans prepared for the construction of a 1 story plant. Estimated cost $35,000. H. H. Bolin, Financial Center Bldg., Archt. and Engr.

**Colo., Pueblo**—Colorado Fuel & Iron Co., c/o L. F. Quigg, Supt., plans to rebuild steelworks, blast furnace, etc. Estimated cost $250,000. Work will be done by day labor.

**Conn., Bridgeport**—Acme Shear Co., Hick St., has work under way on a 2 story, 31 x 47 ft. addition to factory.

**Conn., Greenwich**—Conde Nast Publishing Co., Post Road, will soon award contract for the construction of a 1 story, 60 x 140 ft. electrotyping building. Estimated cost $40,000. W. Higginson, 101 Park Ave., New York, N. Y., Archt.

**D. C., Washington**—Office of D. Lynn, Capitol Architect, received low bids for construction of an underground garage, terrace, etc. in Capitol grounds.

**Ill., Quincy**—Bd. of Eduction, W. E. White, Secy., awarded contract for the construction of a 3 story, 224 x 310 ft. high school including machine shop, etc., at Jersey and Maine Sts. Estimated cost $1,350,000. Noted Feb. 26.

**Indiana**—National Autohaven Co., 201 North Wells St., Chicago, Ill., will receive bids until June 20 for the construction of a group of servcie stations, each 3 story, 85 x 88 ft. at Attica, Gary, Hammond, Huntington, Kendallville, Kokomo, Frankfort, Auburn, Crawfordsville, Decatur, Fort Wayne, Marion, Michigan City and Mishawaka. Estimated total cost $700,000. Private plans.

**Ind., South Bend**—Notre Dame University, awarded contract for the construction of a 2 story engineering college building on Campus. Estimated cost $500,000.

**Ia., Carroll**—F. Gray, will soon receive bids for the construction of a 1 story, 70 x 130 ft. garage. Estimated cost $25,000. Keffer & Jones, 202 Masonic Temple Bldg., Des Moines, Archts.

**Ia., Cedar Rapids**—Universal Crusher Co., 625 C. Ave. N. W., awarded contract for a 1 story, 62 x 156 ft. factory for the manufacture of sand and gravel crushers, at 636-640 B. Ave. N. W. Estimated cost $25,000.

**Ia., Des Moines** — Interstate Transit Lines, plans the construction of a 1 story bus terminal at 4th St. and Court Ave. Estimated cost $35,000.

**La., Shreveport**—G. E. Lamb, Constructing Quartermaster, Barksdale Field, received lowest bid for the construction of a paint, oil and dope house, post exchange, etc., from K. C. Wilson, Shreveport. $97,840.

**Mass., Boston**—McLaughlin & Burr, 88 Tremont St., Archts., will receive bids until June 15 for alterations to Postal Station including machine shop, etc., at South Postal Station, 735 Atlantic Ave. cor. Beach S. Owner's name withheld. U. S. Government, lessee.

**Mass., Hingham**—Town, W. L. Foster, Chn. Bd. of Selectmen, awarded contract for the construction of a 1 story garage and storage building. Estimated cost $40,000. Noted June 4.

**Mass., Salem**—Estate of Mary M. Creedon, 428 Essex St., is having revised plans prepared for a 1 story addition to garage. Estimated cost $40,000. Andrews, Jones, Biscoe & Whitmore, 50 Congress St., Boston, Archts.

**Minn., Minneapolis** — Moorhead Machine & Boiler Co., 131 Holden St., manufacturers of sand and gravel machinery and boilers, is receiving bids for a 1 story, 50 x 134 ft. factory and machine shop and 24 x 24 ft. office at Second Ave. N. E. and 9th St. Estimated cost $25,000.

**Mo., Brighton**—Bd. of Public Service, St. Louis, is having plans prepared for the construction of a 1 and 2 story, airport terminal building at Lambert-St. Louis municipal airport. Estimated cost $152,000. L. R. Bowen, 301 City Hall, Engr.

**Mo., Kansas City**—State Highway Commission, Jefferson City, awarded contract for the construction of a 2 story, 66 x 98 ft. garage and 2 story, 42 x 52 ft. office at 31st and Quincy Sts. $72,000.

**Mo., Kirkwood**—State Highway Commission, Jefferson City, awarded contract for the construction of a 66 x 98 ft. garage and 42 x 52 ft. office. Estimated cost $80,000. Noted May 14.

**Mont., Billings**—Leavens Livestock & Realty Co., R. Leavens, Pres., will build a 1 story, 41 x 66 ft. tire repairing, brake testing and battery station at First Ave. N. and 31st St. Estimated cost $15,000. Firestone Tire Service Stores, Inc.

**N. J., East Rutherford** — J. T. Camlet, 26 Piaget Ave., Clifton, Archt., will receive bids until July 15 for a 2 story, 38 x 70 ft. factory for East Rutherford Syringe Co., 75 Mozart St. Estimated cost $40,000. Noted May 21.

**N. J., Newark**—J. C. Kohaut, Inc., 117 Green St., postponed construction of 3 story, 50 x 100 ft. woodworking factory on New York Ave. Estimated cost $40,000. Maturity indefinite. Noted April 30.

**N. Y., Buffalo**—Ford Motor Co., Highland Park, Mich., is having plans prepared for the construction of a new assembling plant here. Estimated cost $600,000.

**N. Y., New York**—C. Ciampi Realty & Building Corp., 2095 Ryer Ave., will build a 2 story, 100 x 125 ft. service garage at Morris Park Ave. and Wyatt St. Estimated cost $50,000. M. Siegel, 1775 Broadway, Archt. Work will be done by day labor and separate contracts. Noted May 21.

**N. Y., New York**—H. Lilardo, 78 Woodycrest Ave., White Plains, is having sketches made for the construction of a 100 x 107 ft. service garage at Van Nest Ave. and 178th St. Estimated cost $40,000. M. W. Del Gaudio, 545 5th Ave., Archt.

**N. Y., New York**—Two Hundred Twenty West 61st St. Corp., L. Irish, Pres., 60 West 42nd St., is having sketches made for the construction of a 100 x 250 ft. service garage at 218 West 61st St. Estimated cost $70,000. C. Schaefer, Jr., 332 East 149th St., Archt.

**N. Y., New York** — Two Thousand Fifteen Daly Ave. Corp., M. Savio, Pres., 170 Lexington Ave., is having sketches made for a 2 story, 100 x 115 ft. service garage at River Ave. and McClellan St. Estimated cost $100,000. A. Lombardi, 1221 Sheridan Ave., Archt.

**N. Y., New York**—W. W. Westervelt, 194 Godwin Ave., Ridgewood, N. J., plans alterations to 3 story, 100 x 125 ft. service garage at 252 West 87th St. here. Estimated cost $45,000. LeRoy P. Ward, 252 West 87th St., Archt.

**O., Cincinnati**—Dept. of Public Works, City Hall, is receiving bids for two municipal automobile service, repair and garage buildings. Estimated cost $100,000.

**O., Cleveland** — Addressograph-Multigraph Corp., J. E. Rodgers, Pres., E-40th St. and Perkins Ave., awarded contract for the construction of a 580 x 620 ft. factory, 148 x 160 ft. office and 64 x 68 ft. boiler house on Babbitt Rd. Estimated cost $1,000,000.

**Pa., Arnold**—Bd. of Eduction, C. L. Cotton, Pres., voted $150,000 bonds for the construction of a 2 story, 65 x 120 ft. high school including workshops, etc., on Woodmont St. P. R. L. Hogner, Smithfield Bldg., Pittsburgh, Archt.

**Pa., McKeesport** — Bd. of Education, J. B. Ritchey, Pres., Ariel Bldg., is having plans prepared for the construction of an industrial school including shop, etc. Estimated cost $600,000. C. R. Moffitt, 304 Masonic Temple, Archt. C. L. Wooldridge, Fulton Bldg., Pittsburgh, Consult. Engr. Maturity about June, 1932. Noted Jan. 29.

**Pa., Philadelphia** — Boyertown Burial Case Co., E. L. Mory, Pres., 1211 Arch St., will soon award contract for a 3 story, 34 x 112 ft. plant at Florist and Juniper Sts. Estimated cost $75,000. Private plans.

**Tex., Fredericksburg**—G. W. Land, c/o University of Chicago, Chicago, Ill., H. N. and R. L. Schmerbeck, Kerrville, are having tentative plans prepared for the construction of an asbestos mill to manufacture raw product into market channels here.

**Tex., San Antonio**—Bd. of Education, Lavaca and Water Sts., deferred opening of bids for addition to and remodeling vocational high school at Main and Romana Sts. Estimated cost $175,000. Will equip with machinery and equipment to cost $50,000. Phelps & DeWees, Gunter Bldg., and H. P. Smith, National Bank of Commerce Bldg., Archts. W. E. Simpson Co., Milam Bldg., Engr. Noted May 21.

**Utah, Salt Lake City**—Morrison Bros., 905 South State St., awarded contract for a 131 x 143 ft. garage. Estimated cost $50,000.

**Va., Suffolk**—Pine Forest Products Co., Inc., plans the construction of a 1 story band saw mill. Estimated cost including equipment $70,000.

**Wis., Barron**—Erickson Motor Co., awarded contract for a 1 story, 65 x 150 ft. repair and service garage on Third St. Estimated cost $15,000.

**Wis., Eau Claire**—Dunphy Boat Works, J. Larson, Pres., has work under way on a 1 story, 60 x 100 ft. factory at 1100 Menomonie St., to replace fire loss. Estimated cost $20,000.

**Wis., Jefferson**—Valerius Corp., manufacturers of soda fountains, refrigerating equipment, etc., plans to rebuild 80 x 240 ft. factory recently destroyed by fire.

**Wis., Milwaukee**—Geuder, Paeschke & Frey Co., 38 15th St., awarded contract for a 60 x 138 ft. factory for the manufacture of metal stampings and enameled ware.

**Wis., Superior**—Sampson-O'Connell Motor Co., plans the construction of a 1 story repair and service garage at Belknap St. and Ogden Ave. Architect not selected.

**Wyo., Cheyenne**—Union Pacific R.R. Co., 15th and Dodge Sts., Omaha, Neb., is having preliminary plans prepared for the construction of a round house here. Estimated cost $200,000. G. J. Adamson, Omaha, Ch. Engr.

**W. Va., Chester**—Harker Pottery Co., East Liverpool, O., awarded contract for the construction of a 200 ft. tunnel kiln, also a 1 story, 140 x 200 ft. factory to house new kiln here. Estimated cost $100,000 and $50,000 respectively. Noted April 30.

**N. B., Woodstock**—Haydens Ltd., plans the construction of a sawmill and woodworking plant. Estimated cost $100,000. Equipment will be required.

**C. Z., Coco Solo**—Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract for the construction of an aircraft overhaul shop here. $78,750.

**Que., Montreal**—White Motor Co., 842 East 79th St., Cleveland, O., plans the construction of a branch factory and assembling plant here. Equipment will be required.